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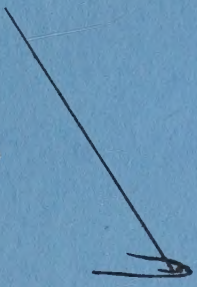
SPORT FISHERY ABSTRACTS



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Narragansett, Rhode Island

SPORT FISHERY ABSTRACTS

An abstracting service for fishery research and management

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Sport Fishery Abstracts is intended to furnish fishery biologists in government agencies and educational institutions with abstracts of the current literature in sport fishery research and management. Abstracts of published articles on limnology, ecology, natural history and other fields of specialization are included when the subject has application to the conservation and management of sport fishery resources.

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15635. Al-Rawi, Tarik, and Dale W. Toetz (Dept. of Zool., Okla. State Univ., Stillwater, Oklahoma). 1972. GROWTH OF WHITE CRAPPIE AND GIZZARD SHAD IN LAKE KEYSTONE, OKLAHOMA. Proc. Okla. Acad. Sci., 52: 1-5.

White crappie, Pomoxis annularis, grew more slowly in Keystone Reservoir during the first three years after impoundment than in other newly impounded waters in Oklahoma. The growth of gizzard shad, Dorosoma cepedianum, decreased during these first three years. Length-frequency histograms suggest that two discrete populations of gizzard shad coexisted in Salt Creek Cove of the lake during 1967. Gizzard shad exhibited the reverse of Lee's phenomenon. (Authors)

15636. Neill, William H., John J. Magnuson and Gerald G. Chipman (Honolulu Lab., SW Fisheries Center, NMFS, Honolulu, Hawaii). 1972. BEHAVIORAL THERMOREGULATION BY FISHES: A NEW EXPERIMENTAL APPROACH. Science, 176(4042): 1443-1445.

Electronic equipment allows fishes, by their spatial movements, to regulate the temperature in experimental tanks. Swimming into warmer water causes the temperature of the entire tank to increase; conversely, swimming into cooler water causes the temperature to decrease. The technique may be adapted for studying simultaneous behavioral regulation of temperature and nonthermal factors. (Authors)

15637. Inoue, Makoto, and Tomoyoshi Kondo (Lab. of Fishing Methodol., Tokyo Univ. Fish., Tokyo, Japan). 1972. ON THE OPTOMOTOR REACTION OF FISH RELEVANT TO FISHING METHOD I. REACTION OF FISH TO VISUAL PATTERNS. J. Tokyo Univ. Fish., 58(1-2): 9-16. (In Japanese with English ab., figs. and tables).

A foundational study was performed on the optomotor reaction relevant to fishing method using dace Moroco steindachneri in an annular trough encircled with a visual screen. Striped and mesh patterns induced similar reactions for all test fish. Fish also responded to a fish pattern but showed weak reaction to a rope pattern - only 3 of 10 fish followed the screen. No significant difference in fish reaction was observed with mesh sizes between 3-15 cm, or square- or diamond-shaped meshes. It is suggested that a visual stimulus is useful to control fish movement even if a current has an unfavorable influence on the fish in the natural environment. (Authors)

15638. Manar, Thomas A. (Sci. Publications Staff, NMFS, Bldg. 67, Naval Support Activity, Seattle, Washington 98115). 1972. FISHERY PUBLICATIONS, CALENDAR YEAR 1971: LISTS AND INDEXES. NOAA Technical Report NMFS CIRC-372, 24 p. For sale by Supt. of Documents, U. S. Govt. Printing Office, Wash., D. C. - price 30 cents.

The following series of fishery publications of the National Marine Fisheries Service, National Oceanic and Atmospheric Administration, in calendar year 1971 are listed numerically (with abstracts) and indexed by author, subject, and geographic area: NOAA Technical Report CIRC (formerly Circular); Data Report; Fishery Leaflet; and NOAA Technical Report NMFS SSRF (formerly Special Scientific Report - Fisheries). (Auth.)

15639. Richards, William J., and Witold L. Klawe (NMFS, Southeast Fisheries Center, Miami Lab., Miami, Florida 33149). 1972. INDEXED BIBLIOGRAPHY OF THE EGGS AND YOUNG OF TUNAS AND OTHER SCOMBRIDS (PISCES, SCOMBRIDAE), 1880-1970. NOAA Technical Report NMFS SSRF-652, 107 p. For sale by Supt. of Documents, U. S. Govt. Printing Office, Wash., D. C. - price $1.00.

This bibliography enumerates reports on the early life history of tunas and other scombrid fishes published before 1971. All the entries are indexed, usually by species, but on occasion by a larger taxonomic unit, and within each taxonomic unit the entries are indexed by one or more subjects. (Authors)

15640. Quast, Jay C., and Elizabeth L. Hall (NMFS, Auke Bay Fish. Lab., Auke Bay, Alaska 99821). 1972. LIST OF FISHES OF ALASKA AND ADJACENT WATERS WITH A GUIDE TO SOME OF THEIR LITERATURE. NOAA Technical Report NMFS SSRF-658, 47 p. For sale by Supt. of Documents, U. S. Printing Office, Wash., D. C. - price 50 cents.

The authors list 432 species known to occur in Alaska waters, supplemented by 137 species that have been recorded from neighboring waters and, in the authors' opinion, should be considered when new collections are identified. Species entries are annotated to include common names, recorded range, useful references, localities represented by specimens in the collection of the Auke Bay Fisheries Laboratory, and comments on taxonomy. Recorded geographic ranges are extended for 26 species: Ophidiidae - Spectrunculus radcliffei; Scorpaenidae - Sebastes emphaeus, S. nigrocinctus, S. wilsoni; Cottidae - Eurymen gyrinus, Gymnocanthus detrisus, G. pistilliger, Hemilepidotus zapus, Icelus spatula, I. uncinalis, Myoxocephalus jaok, Nautichthys pribilovius, Triglops scepticus; Agonidae - Agonopsis emmelane, Aspidophoroides bartoni, Ocella verrucosa; Cyclopteridae - Careproctus melanurus, C. rastrinus, Cyclopteropsis phrynoides, Liparis bristolense, L. ochotensis, Paraliparis caudatus, P. deani, Temnocora candida; Scombridae - Thunnus thynnus; Pleuronectidae - Limanda proboscidea. (Authors)

15641. Gruchy, C. G. (Ichthyology Unit, Nat. Mus. of Nat. Sci., Ottawa, Canada). 1971. SALMON NOMENCLATURE. Nature, 234(5328): 360.

A brief discussion is presented concerning the subspecific names "europaeus" and "americanus" proposed by Payne, Child and Forrest for the Atlantic salmon, Salmo salar.

15642. Zitko, V. (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. DETERMINATION, TOXICITY AND ENVIRONMENTAL LEVELS OF PHTHALATE PLASTICIZERS. Fish. Res. Bd. of Canada Technical Report No. 344, 37 p.

The production, properties, uses, toxicity, and determination of phthalates are reviewed. A cleanup of biological samples is described for the determination of phthalates. The cleanup can be incorporated into a chromatography procedure used for the determination of chlorinated hydrocarbons. Phthalates, extracted from biological samples with hexane, are partially separated from lipids by chromatography on alumina to yield fractions in which the common phthalate plasticizers can be quantitated by gas chromatography. An additional cleanup is achieved by the extraction of phthalates from hexane into dimethyl formamide. Phthalates can be then confirmed by measurement of fluorescence in concentrated sulfuric acid. Dibutyl phthalate was detected in eggs of double-crested cormorants (Phalacrocorax auritus) and herring gulls (Larus argentatus) in levels from 11 to 19 μg/g lipid. Di-2-ethyl-hexyl phthalate was detected in hatchery-reared juvenile Atlantic salmon (Salmo salar) at 13-16 μg/g lipid, in the blubber of a common seal pup (Phoca vitulina) at 11 μg/g lipid, and in commercial fish food at 8-9 μg/g lipid. The food also contained 5-8 μg/g lipid of dibutyl phthalate. (Auth.)

15643. Gillen, Robert G., and Austen Riggs (Dept. of Zool., Univ. of Texas at Austin, Austin, Texas 78712). 1972. STRUCTURE AND FUNCTION OF THE HEMOGLOBINS OF THE CARP, Cyprinus carpio. J. Biol. Chem., 247(19): 6039-6046.

Amino acid analysis and tryptic peptide mapping indicate that the α chains of the three major hemoglobin components are significantly different, whereas either no or very slight differences were found among the β chains. The amino acid sequence of the first 28 residues of the β chain of Component I indicates that the A helix is probably the same length in both carp and human β chains. The oxygen equilibria of the isolated components, I, II and III, appear to be indistinguishable from one another. ATP enhances the normal alkaline Bohr effect of carp hemoglobin, and CO_2 depresses the Bohr effect between pH 7 and 8. Cooperativity as measured by n in Hill's equation is maximal at about pH 6.5 in 0.05 M bis-(2-hydroxyethyl)-imino-tris-(hydroxymethyl)methane, 0.1 M NaCl but shifts to pH 7.5 in the presence of saturating ATP. A simple model suggests that cooperativity

in carp hemoglobin may require the presence of a particular set of protonated species, the concentration of which is maximal at about pH 6.5. The model suggests that the alkaline shift in the position of this maximum in the presence of ATP may result from the preferential binding of ATP at low pH. (Authors)

15644. FAO of the United Nations (Rome, Italy). 1972. FAO AQUACULTURE BULLETIN. A QUARTERLY NEWS DIGEST OF AQUACULTURE RESEARCH AND DEVELOPMENT. FAO Aquaculture Bull., 4(4): 24 p., illus.

Contents include: From research institutions... Live food for marine fish larvae - Culture of Daphnia - Feed conversion of tilapia - Feeds for common carp - Trout culture in warm-water ponds - Culture of shrimps in sewage-fed ponds - High density culture of catfish - Blue catfish culture - Growth and production of Clarias - Harvesting technique and fingerling production in minnow ponds - "Herding" of fish - Fish farm engineering studies. Aquaculture development... Congo - Fiji - Greece - Hungary - Iran - Japan - Madagascar - New Zealand - United States - Zaire. Fish diseases and their control... Viral haemorrhagic septicaemia (VHS) - IPN in Denmark - Ulcerative dermal necrosis (UDN) - Infectious dropsy of cyprinids - Pathogenesis of infectious haematopoietic necrosis (IHN) - Bacterial gill disease of European elvers - Furunculosis in Norway - Whirling disease in natural waters - Epistylis infestation of penaeid shrimp - Effect of phenols on fish. Fish and shellfish introductions... Recent introductions - Introduction of green mussel in the United States - Spawning of Chinese carps in Nepal. Meetings, symposia and workshops. FAO's current field projects in aquaculture... UNDP projects - FAO/UNICEF-Assisted Applied Nutrition projects - World Food Programme projects - Fellowships. (From contents)

15645. Sorgeloos, P., and G. Persoone (Lab. for Ecology, State Univ. of Ghent, Ghent, Belgium). 1972. THREE SIMPLE CULTURE DEVICES FOR AQUATIC INVERTEBRATES AND FISH LARVAE WITH CONTINUOUS RECIRCULATION OF THE MEDIUM. Marine Biology, 15(3): 251-254.

The 3 culturing devices described are based on the principle of the classic air-water lift, which facilitates continuous recirculation and aeration of the cultivation medium. The first device is a "circulation cylinder", convenient for hatching eggs of the brine shrimp Artemia salina and for culturing algae and protozoans. In the second device, an internal basket (i.e., a glass cylinder with plankton-gauze bottom) prevents the animals being carried along in the air-water lift. The third device, analogous to the second, is provided with a lateral waste-drain and a water collector with siphon, which empties regularly into the main culture vessel. The second and third devices proved to be excellent for the cultivation of a variety of aquatic metazoans. They fulfill two elementary principles of cultivation: food particles are kept in suspension and evenly distributed, and the necessary aeration is provided without injuring sensitive animals. (Authors)

15646. Earnest, R. D., and P. E. Benville, Jr. (Bur. of Sport Fish. & Wildl., Div. of River Basin Studies, Sacramento, California). 1971. CORRELATION OF DDT AND LIPID LEVELS FOR CERTAIN SAN FRANCISCO BAY FISH. Pesticides Monitoring Journal, 5(3): 235-241; Selected Water Resources Abstracts, 5(17): p. 45, 1972.

During 1969, residue levels of DDT and its metabolites were determined monthly for eight species of fish and one species of crab collected from two sites in San Francisco Bay, California. Total residue levels were highest in dwarf and shiner perch and lowest in flatfish and crabs. Lipid concentrations were determined in all animals. Correlation coefficients were calculated for percent lipid versus concentrations of DDE, DDD, DDT, and total DDT (DDE + DDD + DDT). There was a significant correlation (P less than 0.05) between percent lipid and DDT and its metabolites for white perch, pile perch, and staghorn sculpin. Dwarf perch had a negative correlation.

15647. Pillay, S. R. (Mrs.) (Rome, Italy). 1972. A BIBLIOGRAPHY OF THE GREY MULLETS FAMILY MUGILIDAE. FAO Fisheries Technical Paper No. 109, 99 p.

15648. Lane, E. D., and W. Skrzynski (Fish. Div., Marine Dept., Wellington, New Zealand). 1972. DISTRIBUTION OF NATIVE AND INTRODUCED FISHES IN THE HINDS RIVER SYSTEM. N. Z. Marine Dept. Fisheries Technical Report No. 87, 29 p.

The Hinds River is about 40 miles long and flows to the east coast in the central part of the South Island of New Zealand. The catchment has been drastically changed by European colonists in the last century. Eleven native and three introduced fish species have been recorded from the Hinds River and its tributaries. Their distribution and abundance are discussed. The mutually exclusive distribution of Salmo trutta and Salvelinus fontinalis, with Salvelinus fontinalis in the upper tributaries and Salmo trutta throughout the rest of the river, is probably caused by temperature differences in association with other features. (Authors summ.)

15649. Takeuchi, Isamu (Hokkaido Reg. Fish. Res. Lab., Yoichi, Hokkaido, Japan). 1972. FOOD ANIMALS COLLECTED FROM THE STOMACHS OF THREE SALMONID FISHES (Oncorhynchus) AND THEIR DISTRIBUTION IN THE NATURAL ENVIRONMENTS IN THE NORTHERN NORTH PACIFIC. Bull. Hokkaido Fish. Res. Lab. No. 38, 119 p. + appendices. (In Japanese with English figures, tables and appendices).

The purpose of this study is to observe the diets of salmonid fishes in oceanic life, and also the period of occurrence and the pattern of distribution of the important food animals in the natural environments in three regions, i.e., the northwestern of the North Pacific, the Okhotsk Sea and the Bering Sea. The stomach analysis was made on three species of the salmonid fishes, i. e., Oncorhynchus nerka, the sockeye salmon; O. keta, the chum salmon; O. gorbuscha, the pink salmon.

15650. Fowler, Laurie G., and Joe L. Banks (Bur. of Sport Fish. and Wildl., Abernathy Salmon Cultural Development Center, Longview, Washington 98632). 1972. ALTERATION TESTS OF THE ABERNATHY SALMON DIET, 1971. Technical Papers of the Bur. of Sport Fish. & Wildl. No. 64, 12 p.

Feeding trials using fall chinook salmon fingerlings (Oncorhynchus tshawytscha) were conducted at the Salmon Cultural Laboratory, Longview, Wash., during 1971 for the purpose of improving the Abernathy diet formula. The results indicated that cottonseed meal could replace a portion of the fish meal in the diet without reducing fish growth, but similar substitutions of wheat and corn gluten meal reduced growth. Fish growth was significantly increased when a diet containing 50 percent protein and 3,350 kcal per kilogram was fed as compared with a diet containing 45 percent protein and 3,350 kcal per kilogram. Soybean lecithin proved to be equal to soybean oil as a caloric source when fed at 2 percent of the diet. Two types of dried whey product with different levels of lactose content produced similar growth response. Reducing the dried whey portion of the diet to 5 percent did not affect growth, nor did methionine supplementation produce any effects. Anchovy meal was unsuitable as a replacement for herring meal. (Authors)

15651. Levin, M. A., R. E. Wolke, and V. J. Cabelli (Dept. of Bacteriology and Biophysics, and Marine Experiment Sta., Univ. of R. I., Kingston, Rhode Island). 1972. Vibrio anguillarum AS A CAUSE OF DISEASE IN WINTER FLOUNDER (Pseudopleuronectes americanus). Can. J. Microbiol., 18(10): 1585-1592.

Vibrio anguillarum was repeatedly isolated from skin and muscle lesions of the winter flounder, Pseudopleuronectes americanus. The dermal lesions, usually accompanied by fin necrosis, included petechiae and ecchymoses in their acute phase and frank ulceration in their more chronic manifestations. Anemia, as evidenced by lowered hematocrit values and increased renal hematopoiesis, was present. The disease was reproduced experimentally by the intradermal injection of as few as 640 V. anguillarum cells. The differential identification of the V. anguillarum isolates from aeromonads, plesiomonads, and other marine vibrios was described and discussed. (Authors)

15652. Roth, Rene R. (Dept. of Zool., Univ. of W. Ontario, London, Ontario, Canada). 1972. SOME FACTORS CONTRIBUTING TO THE DEVELOPMENT OF FUNGUS INFECTION IN FRESHWATER FISH. Journal of Wildlife Diseases, 8(1): 24-28.

The intravenous administration of 1 mg of: cortisol, cortisone, estradiol or progesterone, or the infusion of 5 i.u./kg body weight/24 h of thyroid stimulating hormone, had a facilitating effect upon fungus growth on the freshwater teleost Catostomus commersonii commersonii Lacépède. The same dose (1 mg) of corticosterone or testosterone or adrenocorticotrophin (5 i.u./kg/24 h) did not have this facilitating effect. The possible role of steroids in the mechanism of action of temperature in promoting infections in fish is discussed. (Auth.)

15653. Hoffman, G. L., Sr., and G. L. Hoffman, Jr. (Eastern Fish Disease Lab., Kearneysville, West Virginia). 1972. STUDIES ON THE CONTROL OF WHIRLING DISEASE (Myxosoma cerebralis) I. THE EFFECTS OF CHEMICALS ON SPORES in vitro, AND OF CALCIUM OXIDE AS A DISINFECTANT IN SIMULATED PONDS. Journal of Wildlife Diseases, 8(1): 49-53.

Based on presumptive evidence of death (extrusion of polar filaments and disintegration of sporoplasm) 1.0%, 0.5% and 0.25% calcium oxide or potassium hydroxide killed the spores of Myxosoma cerebralis in vitro. Chlorine at 400 ppm destroyed 36% to 90% of the spores but 13% to 37% of those in the controls perished. Calcium hydroxide, ammonium chloride, sodium borate, potassium permanganate, Roccal (alkyl dimethylbenzylammonium chloride), and copper sulfate allowed survival of 38-96% of the spores, usually not much less than the rate of survival of the controls. In simulated pond testing, quicklime at 380 grams or more per square meter (3360 lbs/acre) of pond bottom prevented whirling disease in rainbow trout (Salmo gairdneri). (Authors)

15654. Ball, H. J., A. L. S. Munro, A. Ellis, K. G. R. Elson, W. Hodgkiss, and I. S. McFarlane (Marine Lab., Aberdeen, Scotland). 1971. INFECTIOUS PANCREATIC NECROSIS IN RAINBOW TROUT IN SCOTLAND. Nature, 234(5329): p. 417.

Infectious pancreatic necrosis (IPN) has now been positively identified as causing an epizootic of rainbow trout fry (Salmo gairdneri) in a Scottish trout farm during February and March this year.

15655. Snieszko, S. F. (Eastern Fish Disease Lab., Leetown, Kearneysville, West Virginia). 1972. PROGRESS IN FISH PATHOLOGY IN THIS CENTURY. Symp. zool. Soc. Lond. No. 30, 1-15.

Modern epidemiology is based on the premise that epidemic outbreaks are caused by an imbalance between the hosts, the pathogens or other disease agents and the environment. Aquatic cold-blooded animals are much more affected by the environment than are the terrestrial homeotherms. Therefore outbreaks of various diseases of fish are strongly affected by ecologic factors. In this brief review of the highlights of the history of fish pathology, diseases which show clearly the role of environment were selected as examples. Owing to the training and experience of the reviewer, most of the examples were selected from among diseases caused by bacteria. (Auth. synopsis)

15656. Groot, C., K. Simpson, C. E. Turner, and F. Nash (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. ANALYSIS OF ULTRASONIC TRACKING RECORDS OF ADULT SOCKEYE SALMON MIGRATION IN BABINE LAKE. Fish. Res. Bd. of Canada Technical Report No. 335, 143 p.

Migratory pathways of adult sockeye salmon (Oncorhynchus nerka) on their way to the spawning grounds in Babine Lake were monitored by ultrasonic tracking techniques in 1969 and 1970. This report presents procedures and computer programs used for processing the tracking data. It also contains instructions for coding meteorological and other environmental data for further analysis.

15657. Estes, R. Don (Bur. of Sport Fish. & Wildl., Va. Coop. Fishery Unit, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1972. ECOLOGICAL IMPACT OF FLUCTUATING WATER LEVELS IN RESERVOIRS. Ecological Impact of Water Resource Development, a technical session of the Symposium, "Water, Man, and Nature", REC-ERC-72-17, pp. 7-9.

There are many problems associated with changes in water levels in reservoirs; however, the use of water-level fluctuations for enhancing the usefulness of reservoirs is promising. Biologists need to conduct additional studies on water-level changes in order that this technique in reservoir fishery management might become a more useful tool. Better communications between the biologists and engineers is also sometimes needed. Optimum use for all users can be approached only when fishery management and reservoir management become integrated.

15658. Barton, James R., David A. White, Parley V. Winger, and Edward J. Peters (Dept. of Civil Engineering, Brigham Young Univ., Provo, Utah). 1972. THE EFFECTS OF HIGHWAY CONSTRUCTION ON FISH HABITAT IN THE WEBER RIVER, NEAR HENEFER, UTAH. Ecological Impact of Water Resource Development, a technical session of the Symposium, "Water, Man, and Nature", REC-ERC-72-17, pp. 17-28.

The results of this study indicate that the structures built into changed channels of the Weber River have been effective in producing fish habitat that is comparable to, if not better than, the habitat of the unchanged sections. Deflector structures placed in the backwater area of a check dam and on the inside of a bend in the river will not be effective in producing good habitat. The decrease in the length of the river is one of the disadvantages of channelization. Where feasible, consideration should be given to maintaining the overall length of a stream. Structures made of large riprap material are often more economical and they produce good fish habitat. Invertebrates colonized the new river bottom and produced equivalent numbers and species after 6 months. Fish populations were essentially equal in changed and unchanged areas 2 years after the construction. More work needs to be done to establish the best combination or system of structures which will create a good habitat over a given length of river channel. (Authors concl.)

15659. Hoffman, Robert G., and Hiroshi Yamauchi (Hawaii Agric. Exp. Sta., Univ. of Hawaii, Honolulu, Hawaii). 1972. RECREATIONAL FISHING. ITS IMPACT ON STATE AND LOCAL ECONOMIES. Coll. of Tropical Agric., Hawaii Agric. Exp. Sta., Univ. of Hawaii Departmental Paper 3, 38 p.

The primary objectives of the study herein described were to estimate the participation in the various kinds of recreational fishing activities, to estimate the expenditures of recreational fishermen, and to estimate the economic impact of recreational fishing on the State of Hawaii.

15660. Rommell, S. A., Jr., and J. D. McCleave (Dept. of Zool., Univ. of Maine, Orono, Maine). 1972. OCEANIC ELECTRIC FIELDS: PERCEPTION BY AMERICAN EELS? Science, 176(4040): 1233-1235.

American eels, long-distance migrating fish, consistently exhibited conditioned cardiac deceleration responses to electric fields as small as 0.167×10^{-2} microampere per square centimeter in water of resistivity 4000 ohm centimeters (6.7 microvolts per centimeter) and 400 ohm centimeters (0.67 microvolt per centimeter). Fewer responses were shown at this current density (0.167×10^{-2} microampere per square centimeter) in more saline water (40 ohm centimeters, 0.067 microvolt per centimeter) and at a lower current density (0.167×10^{-3} microampere per square centimeter) in fresh water. Thus, eels have sufficient sensitivity to utilize geoelectric information for orientation. (Authors)

15661. Dickson, Kenneth L., and John Cairns, Jr. (Biol. Dept. and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia). 1972. ECOLOGICAL DATA FOR WATER RESOURCES MANAGEMENT. Ecological Impact of Water Resource Development, a technical session of the Symposium, "Water, Man, and Nature", REC-ERC-72-17, pp. 1-6.

15662. Wilkens, Noël P. (Dept. of Zool., Univ. College, Galway, Ireland). 1972. BIOCHEMICAL GENETICS OF THE ATLANTIC SALMON Salmo salar L. I. A REVIEW OF RECENT STUDIES. Journal of Fish Biology, 4(4): 487-504.

In recent years, blood group and protein polymorphisms in Atlantic salmon have been investigated extensively with a view, primarily, to their use in identifying individuals of different spawning populations present in high seas fisheries. Erythrocyte antigens, haemoglobins, serum proteins and various tissue enzymes - mainly esterases and dehydrogenases - have been studied by electrophoretic and immunological techniques. These studies are reviewed here for the first time. Many of the protein systems exhibit multiple components and this fact, together with cytological evidence, indicates the occurrence of tetraploidy in the course of Salmonid evolution. The significance of a tetraploid origin in the evolution and ecological adaptation of Salmonids is discussed briefly. Some protein systems studied exhibit phylogenetic variation, and analyses of phenotype ratios and allele frequencies indicate that the populations of different river systems are genetically distinct. Allele frequencies have not yet been shown to be stable from generation to generation however, and some of the factors likely to affect allele frequencies are discussed. Different spawning populations cannot be identified in high seas fisheries using these protein characters, although it may be possible to identify the continent of origin (N. America or Europe) of some individuals. Indeed, it has been proposed independently by two groups that North American and European populations of Atlantic salmon be assigned to different sub-species viz. S. s. americanus and S. s. europaeus respectively. The contradictory evidence on which these taxa are proposed is discussed, together with the evidence for other population groups proposed in the European part of the salmon's range. The possible role and future direction of studies on the biochemical genetics of salmon are outlined. (Auth.)

15663. Wilkens, Noël P. (Dept. of Zool., Univ. College, Galway, Ireland). 1972. BIOCHEMICAL GENETICS OF THE ATLANTIC SALMON Salmo salar L. II. THE SIGNIFICANCE OF RECENT STUDIES AND THEIR APPLICATION IN POPULATION IDENTIFICATION. Journal of Fish Biology, 4(4): 505-517.

See Abstract No. 15662.

15664. Blaxhall, Peter C. (Dept. of Chem. and Biol., Trent Polytechnic, Nottingham, England). 1972. THE HAEMATOLOGICAL ASSESSMENT OF THE HEALTH OF FRESHWATER FISH. Journal of Fish Biology, 4(4): 593-604.

A review is made of some selected literature regarding the use of haematological techniques in freshwater fish pathology. Comparisons are drawn with the techniques already widely used in human pathology for the assessment of health and for aid in diagnosis of various diseases and conditions. The need for information on normal values, and on the conditions under which these were formulated, and the factors affecting them is stressed. The use of haematological values in assessing sublethal concentrations of environmental pollutants and the possibility of chromosomal changes are considered. (Auth.)

15665. Bengtsson, B. E. (Section of Ecol. Zool., Univ. of Umeå, Sweden). 1972. A SIMPLE PRINCIPLE FOR DOSING APPARATUS IN AQUATIC SYSTEMS. Archiv für Hydrobiologie, 70(3): 413-415. In English.

A dosing apparatus for toxicological investigations has been constructed. The working unit is driven by the diluting water and no other power supply is needed. The apparatus is easily built in a workshop and the price is remarkably low in comparison with most commercial dosing pumps. It has in its cheapest form an uncertainty in concentration of ± 1 percent. (Auth.)

15666. Mann, Theodore E. (Missouri-Souris Projects Office, Bur. of Reclamation, Bismarck, North Dakota 58501). 1972. MANAGEMENT OF WASTE MATERIAL FROM McCLUSKY CANAL FOR ENVIRONMENTAL ENHANCEMENT. Ecological Impact of Water Resource Development, a technical session of the Symposium, "Water, Man, and Nature", REC-ERC-72-17, pp. 11-15.

15667. Allen, George H. (Fisheries, School of Nat. Resources, Humboldt State Coll., Arcata, California 95521). 1972. NOTES ON SAMPLING AMPHIPODS AND EUPHAUSIIDS IN THE NORTH PACIFIC OCEAN. Trans. Amer. Fish. Soc., 101(4): 577-582.

Amphipods and euphausiids caught in Clarke-Bumpus, 1-meter, and 1/2-meter nets fished at the same stations within the North Pacific Ocean and the Gulf of Alaska during the spring of 1956, were compared by simple correlation analysis. Variable correlation in the catch of amphipods by day or night was probably due to patchiness and diurnal migration. A good correlation in catch of euphausiids in the three nets was found for stations sampled at night with coarse mesh and in areas devoid of phytoplankton blooms. There was some evidence that a low catch of euphausiids during the day was a function of availability rather than net avoidance. (Auth.)

15668. Saila, S. B., T. T. Polgar, D. J. Sheehy, and J. M. Flowers (Marine Exp. Sta., Univ. of R. I., Kingston, Rhode Island 02881). 1972. CORRELATIONS BETWEEN ALEWIFE ACTIVITY AND ENVIRONMENTAL VARIABLES AT A FISHWAY. Trans. Amer. Fish. Soc., 101(4): 583-594.

An automatic recording system for fish counting and for the monitoring of water temperature, dissolved oxygen, pH and solar radiation was employed on a newly constructed fishway on the Annaquatucket River, North Kingstown, Rhode Island. Records of fishway utilization by the alewife, Alosa pseudoharengus and of the environmental variables were critically examined by time series autocorrelation techniques. It was demonstrated that migratory activity was harmonic with a diurnal periodicity and was closely associated with incident solar radiation. Suggestions for an improved monitoring system and further analysis were made. (Authors)

15669. Burns, James W. (Inland Fish. Branch, Calif. Dept. of Fish and Game, Sacramento, California 95819). 1972. THE DISTRIBUTION AND LIFE HISTORY OF SOUTH AMERICAN FRESHWATER CRABS (Aegla) AND THEIR ROLE IN TROUT STREAMS AND LAKES. Trans. Amer. Fish. Soc., 101(4): 595-607.

Freshwater crabs (Aegla) were collected in Chile and Argentina in 1971 and shipped to California for laboratory observations to determine the desirability of introducing them into California as forage for trout. Stomachs and scales taken from Chilean trout were examined to determine the importance of Aegla in the diet and growth of trout. Aegla made up 66% of the dry weight of the identifiable stomach contents of river-dwelling rainbow trout (Salmo gairdneri) and 67% of the stomach contents of river-dwelling brown trout (S. trutta). However, they were not as important as fish in the diets of lake-dwelling trout. The growth rates of Chilean trout sampled from waters containing Aegla were rapid, suggesting that the abundant crab populations probably contribute significantly to the large size attained by Chilean trout. Laboratory observations confirmed that Aegla are detritivores and herbivores; in addition, they were found to be predators. Besides eating detritus and periphyton, they preyed upon aquatic insects and fish. In an experiment, they crawled through 26 cm of rubble and gravel-sized rocks into two simulated trout redds and consumed 76% of the trout embryos and alevins. Because of the possible deleterious effects Aegla predation could have upon salmonid reproduction, the proposal to introduce them into California waters was rejected. (Auth.)

15670. Reid, William F., Jr. (Maine Coop. Fish. Unit, Univ. of Maine, Orono, Maine 04473). 1972. UTILIZATION OF THE CRAYFISH Orconectes limosus AS FORAGE BY WHITE PERCH (Morone americana) IN A MAINE LAKE. Trans. Amer. Fish. Soc., 101(4): 608-612.

White perch (Morone americana) under 201 mm long from a lake containing the crayfish Orconectes limosus ate mostly insects. Perch from 201 to 280 mm long fed upon insects, fish, and crayfish. White perch over 280 mm fed mainly upon crayfish. Young-of-the-year O. limosus were rarely utilized as forage by white perch. White perch under 201 mm long from a lake not having crayfish fed

mostly upon insects but also ate fish. Perch over 200 mm long were almost exclusively piscivorous, the main forage fish being the rainbow smelt (Osmerus mordax). (Auth.)

15671. Bonneau, D. L., J. W. McGuire, O. W. Tiemeier, and C. W. Deyoe (Iowa Conservation Commission, Griswold, Iowa). 1972. FOOD HABITS AND GROWTH OF CHANNEL CATFISH FRY, Ictalurus punctatus. Trans. Amer. Fish. Soc., 101(4): 613-619.

Polyethylene-lined rearing ponds were used in 1968 and 1969 in the study of effects of certain treatments on food habits and growth of young-of-the-year channel catfish (Ictalurus punctatus). Two ponds were used in 1968, a fed pond and a pond enriched with inorganic fertilizer. In 1969 the study was expanded to four ponds; two receiving treatments similar to those in 1968, a control pond, and a fed-and-enriched pond. Weekly samplings of fish, benthos, plankton, and water provided data for determining treatment effects. Enrichment with two inorganic fertilizers variously affected the algae, zooplankton, and benthic communities. No significant difference was noted in the mean growth (weight and length) of fry in the fed pond and in the fed-and-enriched pond. Fish production and survival were not improved by enriching ponds. Feeding habits of young-of-the-year channel catfish varied with availability of food items. Analyses of stomach contents indicated that fry, after accepting supplemental feed, consumed many natural foods in direct proportion to their availability. Fry in continually fed ponds were approximately 5 weeks old when they first accepted supplemental feed, which thereafter comprised most of the food they ate and was responsible for their consistent growth rate. The advantage of supplemental feed became especially apparent as the fry became larger and demand for food increased. In the absence of supplemental feed, nonavailability of adequate natural food limited growth. (Authors)

15672. Oseid, Donavon, and Lloyd L. Smith, Jr. (Dept. of Entomol., Fish., and Wildl., Univ. of Minn., St. Paul, Minnesota 55101). 1972. SWIMMING ENDURANCE AND RESISTANCE TO COPPER AND MALATHION OF BLUEGILLS TREATED BY LONG-TERM EXPOSURE TO SUBLETHAL LEVELS OF HYDROGEN SULFIDE. Trans. Amer. Fish. Soc., 101(4): 620-625.

After 126 or 148 days of exposure to H_2S concentrations ranging from .0004 to .0146 mg/l, young-of-the-year bluegills were tested for swimming endurance and resistance to copper or malathion. Swimming tests at low speeds indicated increased endurance for fish exposed to .0004 mg/l H_2S, but fish exposed to higher concentrations had progressively less endurance than the controls. In the tests conducted at higher speeds fish in all test concentrations showed less endurance than the controls. Resistance to copper was increased by exposure to H_2S, but resistance to malathion was not affected except in the lowest test concentration. The chronic exposure to H_2S also reduced growth in the highest concentration, and gill irrigation rate increased progressively with increased concentrations. (Authors)

15673. Batts, Billy S. (Dept. of Nat. Sciences, Longwood College, Farmville, Virginia 23901). 1972. SEXUAL MATURITY, FECUNDITY, AND SEX RATIOS OF THE SKIPJACK TUNA, Katsuwonus pelamis (Linnaeus), IN NORTH CAROLINA WATERS. Trans. Amer. Fish. Soc., 101(4): 626-637.

Sexual maturity, gonad index relationships, size at maturity, histology of gonadal changes, ova diameter frequencies, fecundity, and sex ratios were determined for skipjack tuna, Katsuwonus pelamis (Linnaeus), from Hatteras and Oregon Inlet, North Carolina. Minimum lengths of sexually mature fish were 435 mm and 454 mm for males and females, respectively. Fifty percent of the females were sexually mature at 500 mm long. Gross and microscopic examination of gonads along with gonad indices demonstrated that late June and early July were peak spawning times. Histological sections of gonads validated the stages of sexual maturity as determined from field examination. The ova diameter frequency of a nearly ripe fish showed three distinct modes: 0.15 mm, 0.50-0.60 mm, and 0.95 mm. Multiplicity of ova diameter modes and the presence of residual ova in fish with a new ripening group of ova demonstrated that skipjack tuna are multiple spawners. Fecundity estimates indicated that a fish 498 mm long spawns 141,000

ova, while a fish 704 mm long spawns 1,200,000 ova. Wide variations in fecundity were noted for fish of similar length and weight. Regression equations for fecundity and length, and fecundity and weight were computed. Chi-square tests indicated a significant difference from the expected 1:1 sex ratio for Oregon Inlet fish subdivided into 50 mm length groups (1965) or taken as a whole (1965, 1966). (Auth.)

15674. Locke, David O., and Keith Havey (Maine Dept. of Inland Fish. and Game, Augusta, Maine 04330). 1972. EFFECTS OF DDT UPON SALMON FROM SCHOODIC LAKE, MAINE. Trans. Amer. Fish. Soc., 101(4): 638-643.

Schoodic Lake, a relatively large glacial kettle located in the blueberry growing area of Washington County, Maine, is in a section where pesticides have been used intensively in blueberry culture for many years. DDT was implicated as the cause of a high hatchery mortality of landlocked salmon eggs and fry from Schoodic Lake in 1968-1969. This implication prompted a controlled study in 1970 to determine more exactly the effects of the pesticide upon salmon eggs and fry with Schoodic Lake as the parental source. DDT and metabolites in salmon eggs and fry from Schoodic Lake ranged from 7.21 to 10.41 ppm as opposed to 0.28 to 1.31 ppm in control fish from West Grand Lake. The Schoodic lot had a total mortality to feeding of 66% as opposed to a 30% mortality in the West Grand Lake fish. DDT and metabolites in mature salmon from Schoodic Lake in fall, 1969 ranged from 4.03 to 12.22 ppm in contrast to a range of 0.11 to 1.03 ppm in mature salmon from West Grand Lake. DDT and metabolites in mature salmon from Schoodic Lake in fall, 1970 ranged from 3.40 to 8.76 ppm. The increased use of guthion, an organophosphate, in the Schoodic Lake area may have a detrimental synergistic effect with DDT upon fish. (Authors)

15675. Kempinger, James J., and Warren S. Churchill (Wis. Dept. of Nat. Res., Woodruff, Wisconsin 54568). 1972. CONTRIBUTION OF NATIVE AND STOCKED WALLEYE FINGERLINGS TO THE ANGLERS' CATCH, ESCANABA LAKE, WISCONSIN. Trans. Amer. Fish. Soc., 101(4): 644-649.

Abundance and yield for various year classes of a landlocked walleye population was studied in a northern Wisconsin Lake. The size of individual year classes varies greatly and is determined during the first summer. The number of fingerling surviving in the fall is an indication of the future role of a year class in the fishery. Yield to the angler of a particular year class over its lifetime depends on the fishing pressure but may not be directly proportional. In Escanaba Lake, as high as 25% of the fingerling surviving in the fall may be harvested by anglers during the life of the year class. Four experimental stockings of marked fingerling walleye were traced through the creel census of which only one of the four added significantly to the harvest. The yield of the successful stocking was 13%. In three of the stocked year classes, the yield was less than 1% of the number stocked. (Authors)

15676. Bennett, David H., and J. Whitfield Gibbons (Savannah River Ecol. Lab., P. O. Drawer E., Aiken, South Carolina 29801). 1972. FOOD OF LARGEMOUTH BASS (Micropterus salmoides) FROM A SOUTH CAROLINA RESERVOIR RECEIVING HEATED EFFLUENT. Trans. Amer. Fish. Soc., 101(4): 650-654.

Largemouth bass (Micropterus salmoides) collected from an area of a South Carolina reservoir at ambient temperatures contained greater amounts of food than bass taken at the entrance of a heated effluent in the same reservoir. Unidentifiable fish occurred in the highest frequency at both areas; sunfish (Lepomis sp.) had the highest frequency of occurrence of all identifiable items. All major dietary components were found in stomachs of bass from both areas from March through May although the relative occurrences of these items varied in the winter, spring, and fall. Increased metabolic requirements on fish living in the heated portion of the reservoir are possibly reduced by individuals entering the waters at extreme temperatures to feed, followed by movement to deeper, stratified waters at lower temperatures. (Authors)

15677. Parsons, John W. (U. S. Fish & Wildlife Serv., Great Lakes Fishery Lab., Ann Arbor, Michigan 48107). 1972. LIFE HISTORY AND PRODUCTION OF WALLEYES OF THE 1959 YEAR-CLASS IN WESTERN LAKE ERIE, 1959-62. Trans. Amer. Fish. Soc., 101(4): 655-661.

Because of the near collapse of the fishery for walleyes (Stizostedion vitreum vitreum) in Lake Erie in the late 1950's, walleyes of the 1959 year-class were studied to gain a better understanding of the life history of the species and the dynamics of the population. In the summer of 1959 most walleyes of the year-class were in water 10 to 20 feet deep along the south and west shores of the western basin. By fall they averaged about 10 inches long and were rather widely distributed throughout the basin. By September 1960 most had reached legal length (then 13 inches in Ohio), and in October they made up nearly the entire commercial walleye production and made the highest monthly contribution during the life of the year-class. Walleyes of the 1959 year-class were cropped intensively and remained in the fishery for only a relatively short time. Estimated Ohio trap net production of the year-class was 261,000 fish in 1960, 168,000 in 1961, and 21,000 in 1962. Few fish survived beyond the spring of 1962. About 97% of the females of the year-class were caught before they had spawned once. (Auth.)

15678. Manion, Patrick J. (U. S. Fish & Wildlife Service, Sea Lamprey Control, Marquette, Michigan 49855). 1972. VARIATIONS IN MALANOPHORES AMONG LAMPREYS IN THE UPPER GREAT LAKES. Trans. Amer. Fish. Soc., 101(4): 662-666.

Among the normally dark colored lampreys in the upper Great Lakes are light colored (yellow) variants. They are far rarer among the Lampetra lamottei (1 of 11,628) and Ichthyomyzon spp. (2 of 9,028) than Petromyzon marinus (671 of 15,432). The general pigment pattern was identical in the yellow and dark colored lampreys, but the shape, number, and degree of expansion of pigment cells differed greatly. (Auth.)

15679. Bailey, Merryll M. (U. S. Fish & Wildl. Service, Ashland, Wisconsin 54806). 1972. AGE, GROWTH, REPRODUCTION, AND FOOD OF THE BURBOT, Lota lota (Linnaeus), IN SOUTHWESTERN LAKE SUPERIOR. Trans. Amer. Fish. Soc., 101(4): 667-674.

This study was based on 1,285 burbot (Lota lota) collected in three areas in southwestern Lake Superior in 1966-69. Age was determined from otoliths, the marginal zones of which were opaque from December to May and translucent from June to November. Average lengths of the age groups and annual increments were measured from a curve fitted by inspection to point estimates of lengths at capture. Burbot grew 5.7 inches during the first year of life and 4.3 inches during the second. Later annual increments through the twelfth year ranged from 1.2 to 2.6 inches. Average total lengths and calculated weights were 16.1 inches and 1.1 pounds at age V and 23.4 inches and 3.2 pounds at age X. First maturity was at age I, at a total length of 9.7 inches for males and 10.7 inches for females; all fish were mature at age V and at lengths greater than 16.4 inches (males) and 15.9 inches (females). Most burbot collected near shore in the Apostle Islands area in late January and February were spent, but none collected in offshore areas during January and March had spawned. The estimated number of eggs in the ovaries of eight burbot 14.7-21.3 inches long ranged from about 268,800 to 1,154,000 and averaged about 812,300. Burbot of all sizes fed on fish and crustaceans. Fish heavily predominated in the food of large burbot taken during the winter (99.6% of the volume) but crustaceans (Mysis and Pontoporeia) became increasingly important during the summer and fall (when they contributed more than 73% of the volume). Due to the wide variety and large volume of food consumed, the burbot is probably a significant competitor of many other species. (Auth.)

15680. McSwain, Lawrence E., and Richard M. Gennings (Ga. Dept. of Nat. Resources, Game and Fish Div., Route 3, Box 582, Albany, Georgia 31701). 1972. SPAWNING BEHAVIOR OF THE SPOTTED SUCKER Minytrema melanops (Rafinesque). Trans. Amer. Fish. Soc., 101(4): 738-740.

15681. Nebeker, Alan V. (U. S. Environ. Protection Agency, Nat. Water Qual. Lab., 6201 Congdon Blvd, Duluth, Minnesota 55804). 1972. EFFECT OF LOW OXYGEN CONCENTRATION ON SURVIVAL AND EMERGENCE OF AQUATIC INSECTS. Trans. Amer. Fish. Soc., 101(4): 675-679.

Safe concentrations of dissolved oxygen for survival and adult emergence of larvae of nine species of aquatic insects, including mayflies, stoneflies, caddisflies, and midges, ranged from 0.6 mg/liter for the midge Tanytarsus dissimilis to slightly less than saturation for the emergence of Ephemera simulans (18.5 C). All species tested were less tolerant of low oxygen concentrations for 30 days than for 96 hours (90% of E. simulans survived 4 mg/liter for 96 hours, but no adults emerged successfully). Long-term studies are essential for the accurate assessment of oxygen stress in aquatic insects. (Auth.)

15682. Chittenden, Mark E., Jr. (Dept. of Environ. Sciences, Rutgers Univ., New Brunswick, N. J.). 1972. RESPONSES OF YOUNG AMERICAN SHAD, Alosa sapidissima, TO LOW TEMPERATURES. Trans. Amer. Fish. Soc., 101(4): 680-685.

Responses of young American shad, Alosa sapidissima, to low temperatures in fresh water were studied in large aquaria with rapid temperature decreases (about 24 to 12 C) and with slow (1.9 to 0.5 C/day) decreases to 0.7 C in a tank with a temperature gradient. Rapid temperature decreases had no apparent effect. With slow decreases, the fish weakly avoided the cold end below 8 C and strongly below 5 C. Other sublethal effects included extremely sluggish movements below 6 C; cessation of feeding, frequent temporary equilibrium loss, wobbly swimming, and no response to hand movements below 4.4 C; and frequent collision with objects shortly before death. The lower thermal tolerance limit is about 2.2 C; prolonged exposure may increase this, because lethal temperatures depended on exposure time. Sublethal effects suggest that this species may not survive prolonged exposure to 4 to 6 C, particularly during autumn and early winter when the fish may not be acclimated. Temperature plays a multiple role in the diadromous movements of this species. It sets a limit on when the adults can enter and the young must leave fresh water. It masks the stimulus for upstream migration associated with gonadal development. Increases in temperature safely above the lower thermal limit release the expression of the gonadal stimulus. Temperature decreases in northerly rivers trigger a final exodus of young from fresh water. Avoidance and resistance lower the probability of mortality due to catastrophic temperature decreases. Cold water releases may adversely affect spawning and nursery areas below reservoirs. (Auth.)

15683. Grzenda, Alfred R., William J. Taylor, and Doris Fort Paris (Environ. Protection Agency, Nat. Environ. Research Center, Corvallis, Oregon). 1972. THE ELIMINATION AND TURNOVER OF ^{14}C-DIELDRIN BY DIFFERENT GOLDFISH TISSUES. Trans. Amer. Fish. Soc., 101(4): 686-690.

The rates at which ^{14}C-dieldrin is eliminated from various goldfish tissues under experimental conditions are determined and the behavior of dieldrin is compared with that of DDT in a previous similar investigation. Three groups of goldfish (Carassius auratus) were fed a diet contaminated with ^{14}C-dieldrin. When the fish had reached the desired level of exposure, group A was starved, group B was fed an uncontaminated diet, and group C was given a diet contaminated with ^{12}C-dieldrin. Experimental conditions remained the same for all groups during the course of the investigation. The elimination of ^{14}C-dieldrin from various tissues was measured with a low-background gas-flow GM counter. It was found that (1) fish in group A had a high rate of elimination initially, and the subsequent percent decrease in activity was almost the same in all tissues; (2) fish in group B eliminated the contaminant at approximately the same rate from all tissues, but more slowly than those in group A; (3) fish in group C showed relatively rapid and extensive reductions of ^{14}C activity ranging from 62% in skin to 100% in the spleen, immature ovary, and mesenteric adipose tissue; and (4) fish in group B eliminated dieldrin more rapidly than DDT was eliminated in the previous similar investigation. The data presented suggest that fat solubility or adsorptivity is not the most important factor in chlorinated hydrocarbon build-up in the tissues of fish. (Authors)

15684. Saksena, Vishnu P., Charles Steinmetz, Jr., and Edward D. Houde (Dept. of Biol., Muskingum College, New Concord, Ohio 43762). 1972. EFFECTS OF TEMPERATURE ON GROWTH AND SURVIVAL OF LABORATORY-REARED LARVAE OF THE SCALED SARDINE, Harengula pensacolae Goode and Bean. Trans. Amer. Fish. Soc., 101(4): 691-695.

Growth and survival of scaled sardine, Harengula pensacolae, larvae were evaluated in laboratory rearing experiments at temperatures ranging from 21 to 35 C. Fertilized eggs were obtained in plankton collections made near Miami, Florida, in summer 1971. Larvae were reared for 15 days after hatching in temperature-controlled, 75-liter aquaria. Hatching success was high at all temperatures but larvae did not survive at 35 C, and survival was poor at 21-23 C. Survival was best at temperatures between 26 and 32 C. Mean daily growth increments ranged from 0.056 mm at 21-23 C to 1.035 mm at 32 C. Growth in relation to temperature was expressed by the equation $Y = -0.8474 + 0.0537X$, where Y equals daily growth increment and X equals temperature. Larval behavior was normal at 26 to 33.5 C. Critical high and low temperatures for larval survival were 35 C and approximately 20 C. (Authors)

15685. Greenland, Donald C., and Allan E. Thomas (NMFS, Rohwer, Arkansas 71666). 1972. SWIMMING SPEED OF FALL CHINOOK SALMON (Oncorhynchus tshawytscha) FRY. Trans. Amer. Fish. Soc., 101(4): 696-700.

Tests to determine the swimming ability of fall chinook salmon fry were conducted in a stamina tunnel located at the Salmon Cultural Laboratory, Longview, Washington. Fish were subjected to water velocities of 0.6, 0.7, 0.8, and 0.9 ft/sec for periods of 3, 6, and 9 min. The number of fish impinged on a screen placed across the downstream end of the stamina tunnel was noted for each test. The number of fish free of the screen and still swimming at the end of the test period was used as the measure of swimming ability. The smallest group tested, fry 33.0 to 34.9 mm in length, had visible yolk sacs. Ninety-eight percent of these fish were capable of coping with velocities of 0.6 ft/sec for at least 3 min. Only 88% and 72% of these small fish could cope with increased velocities of 0.7 and 0.8 ft/sec. Larger fry performed better; however, a slump in performance in fish 37.0 to 38.9 mm in length was noted. Changes of 0.05 ft/sec caused measurable changes in swimming performance, and the number of fish impinged increased with exposure time. (Authors)

15686. Simmons, George M., Jr. (Va. Commonwealth Univ., Richmond, Virginia 23220). 1972. A PRELIMINARY REPORT ON THE USE OF THE SEQUENTIAL COMPARISON INDEX TO EVALUATE ACID MINE DRAINAGE ON THE MACROBENTHOS IN A PRE-IMPOUNDMENT BASIN. Trans. Amer. Fish. Soc., 101(4): 701-713.

A 35.0 mile segment of the North Anna River Virginia is currently being impounded to provide cooling water for a nuclear reactor. The headwaters of a major tributary of the North Anna River, Contrary Creek, was the site of extensive pyrite mining operations at the turn of the century. Contrary Creek is a source of acid mine drainage, and confluences with the North Anna River approximately midway through the pre-impoundment basin. The sequential comparison method of establishing diversity indices of community structure was used to evaluate the effect of acid mine drainage on the macrobenthos in a 21.5 mile segment of the river. The diversity indices indicated that the North Anna River recovers from acid mine drainage approximately 19.0 miles below the entrance of Contrary Creek or 2.0 miles below the present dam site. However, the molluscan element, which occupied 32% of the macrobenthos at the upstream control station, did not show a reoccurrence within the study area below the discharge of Contrary Creek. The lack of mussel recolonization indicates that the river has only partially recovered from the acid drainage. Even though the Sequential Comparison Technique provides a rapid method of gathering numerical information regarding biological water quality, the technique as currently used does not exhibit sufficient resolution to distinguish between different degrees of biological recovery. (Auth.)

15687. Spoor, W. A., and R. A. Drummond (National Water Quality Lab., Duluth, Minnesota 55804). 1972. AN ELECTRODE FOR DETECTING MOVEMENT IN GRADIENT TANKS. Trans. Amer. Fish. Soc., 101(4): 714-715.

An electrode chamber was described recently in which respiratory and other movements can be recorded from fish and other aquatic animals swimming freely between two stainless steel electrodes. Subsequently, the electrodes have been found to be very useful in the more open conditions of a gradient tank in which, by use of multiple electrodes, an animal's movements, position, and to some extent behavior can be recorded continuously over long periods, under a variety of experimental conditions, and without disturbance by the observer.

15688. Manion, Patrick J. (U. S. Fish and Wildlife Service, Sea Lamprey Control, Marquette, Michigan 49855). 1972. FECUNDITY OF THE SEA LAMPREY (Petromyzon marinus) IN LAKE SUPERIOR. Trans. Amer. Fish. Soc., 101(4): 718-720.

Estimates of the numbers of eggs in ovaries were made for 29 sea lampreys collected on 26 May and 16 June 1960 from the Chocolay River, Marquette County, Michigan. The mean estimated number of eggs in the ovaries of the 29 sea lampreys was 68, 599 (range, 43, 997-101, 932) on a wet-weight basis. As in other studies of sea lamprey fecundity, egg production varied widely and irregularly with length: egg production of four lampreys 376 mm long ranged from a low of 43, 997 to a 64% higher 72, 329.

15689. Noble, Richard L. (Dept. of Natural Resources, Cornell Univ., Ithaca, New York 14850). 1972. MORTALITY RATES OF WALLEYE FRY IN A BAY OF ONEIDA LAKE, NEW YORK. Trans. Amer. Fish. Soc., 101(4): 720-723.

Catch of walleye fry in Billington Bay declined steadily from a high of 0.8-0.9 fry per m^3 to less than .02 fry per m^3 in both 1966 and 1967. Daily mortality rates estimated from adjusted catches were .201 in 1966 and .254 in 1967. Total mortality from 10 to 18 mm mean length based on the adjusted density and estimated from the regression line was 95% in 1966 and 96% in 1967, considerably higher than expected. Possible causes of the mortality occurring during the fry stage are speculative.

15690. Becker, C. Dale (Ecosystems Dept., Battelle Memorial Inst., Pacific Northwest Labs., Richland, Washington 99352). 1972. INITIAL RECORDS OF MONOGENEA FROM JUVENILE BASS IN THE CENTRAL COLUMBIA RIVER, WASHINGTON. Trans. Amer. Fish. Soc., 101(4): 723-726.

During the winter of 1970-71, a survey was made of the monogenetic gill parasites of juvenile largemouth bass, Micropterus salmoides (Lacépède), and smallmouth bass, M. dolomieui (Lacépède) from the Hanford area of the central Columbia River. Five species of Monogenea were recovered: Actinocleidus fusiformis (Mueller, 1934) Mueller, 1937; Clavunculus unguis (Mizelle and Cronin, 1943) Mizelle et al., 1956; Urocleidus furcatus (Mueller, 1937) Mizelle and Hughes, 1938; U. principalis (Mizelle, 1936) Mizelle and Hughes, 1938; and U. helicis (Mueller, 1936) Mizelle and Hughes, 1938. All five species were recovered from the gill structures of juvenile largemouth bass; A. fusiformis was the most common monogenean, followed in decreasing proportions by U. furcatus, U. principalis, and rarely U. helicis and C. unguis (the last on gill arches only). Only A. fusiformis, C. unguis, and U. furcatus were detected on the gills of juvenile smallmouth bass, and the infestations consisted of relatively few individuals compared to those infesting largemouth bass. Indeed, all largemouth were infested whereas many smallmouth were not.

15691. Starkey, Edward E., Joel A. Kazmierski, Milford R. Fletcher, and O. Eugene Maughan (Dept. of Zool., Washington State Univ., Pullman, Washington 99163). 1972. THE EFFECT OF PHOTOPERIOD ON THERMAL RESISTANCE OF SPECKLED DACE. Trans. Amer. Fish. Soc., 101(4): 715-718.

15692. Anderson, Robert D., and Kenneth K. Chew (Coll. of Fish., Fisheries Research Inst., Univ. of Wash., Seattle, Washington 98195). 1972. PRELIMINARY STUDY ON THE TRANSIENT SPECIES OF FISH IN BIG BEEF HARBOR. Trans. Amer. Fish. Soc., 101(4): 726-729.

This study was designed to determine the seasonal cycle of transient fish species utilizing Big Beef Harbor, the estuary of Big Beef Creek, in Hood Canal, Washington. Monthly samples of fish were taken with a large fyke net located near the mouth of Big Beef Harbor. The net was set for a period of 24 hr once each month and the specimens collected were enumerated and measured. The most abundant species of fish collected in this study were the shiner seaperch (Cymatogaster aggregata), the pile seaperch (Rhacochilus vacca), and the surf smelt (Hypomesus pretiosus). The summer period provided the most species and numbers of transient fishes. During December, January, and February, no fish were captured. In general, the greatest numbers and species of transient fishes occurred when temperatures and salinities were at or near their seasonal maxima. (Authors summ.)

15693. Fore, Paul L., and Kenneth N. Baxter (NMFS, Atlantic Coastal Fish. Center, Gulf Breeze Field Sta., Gulf Breeze, Florida 32561). 1972. DIEL FLUCTUATIONS IN THE CATCH OF LARVAL GULF MENHADEN, Brevoortia patronus, AT GALVESTON ENTRANCE, TEXAS. Trans. Amer. Fish. Soc., 101(4): 729-732.

The purpose of this paper is to report catches of larval Gulf menhaden made in a series of collections during a 96-hour period at the mouth of Galveston Bay and to relate these catches to certain environmental conditions. A total of 24,792 larval menhaden, ranging in size from 19.5 to 23.5 mm SL, was captured during 48 tows. The average catch contained 516 menhaden larvae. Peaks of abundance generally occurred at night. Except for the first samples in low light intensities each morning, few larvae were captured during the day. Significant fluctuations in catches of larval Gulf menhaden were observed during day and night cycles as well as between ebb and flood tides. The decreased catch during daylight hours was attributed to net avoidance.

15694. Eckblad, James W., and M. H. Shealy, Jr. (Dept. of Entomology and Limnology, Cornell Univ., Ithaca, New York 14850). 1972. PREDATION ON LARGEMOUTH BASS EMBRYOS BY THE POND SNAIL Viviparus georgianus. Trans. Amer. Fish. Soc., 101(4): 734-738.

The operculate snail Viviparus georgianus Lea is widely distributed in lakes and streams of the eastern United States, where it scavenges for food on the bottom muds. A laboratory experiment was initiated in 1970 and a pond experiment in 1971 to determine if these snails were consuming bass embryos. It was found that V. georgianus will consume largemouth bass embryos under laboratory and pond conditions. In the laboratory, bass embryos were the only food item available. In the pond experiment, a natural complement of alternate foods was available to the snails, and a natural substrate was present. Nest-guarding male bass previously permitted V. georgianus to crawl over masses of incubating bass embryos in these ponds. In these and similar largemouth bass spawning areas where V. georgianus are abundant, predation by this snail may contribute to the high incubation mortality often occurring in largemouth bass.

15695. Marcy, Barton C., Jr., Paul M. Jacobson, and Richard L. Nankee (Essex Marine Lab., Inc., Essex, Connecticut 06426). 1972. OBSERVATIONS ON THE REACTIONS OF YOUNG AMERICAN SHAD TO A HEATED EFFLUENT. Trans. Amer. Fish. Soc., 101(4): 740-743.

This report presents field observations on the reactions of young shad to a heated effluent and attempts to define their upper temperature limit under the conditons existing in the lower Connecticut River. The upper natural temperature limit of young shad may be about 30 C. Young shad avoid potentially lethal temperatures above 30 C and are capable of traversing the heated effluent during their downstream migration.

15696. Howmiller, Richard P. (Dept. of Biol. Sci., Univ. of Calif., Santa Barbara, California 93106). 1972. EFFECTS OF PRESERVATIVES ON WEIGHTS OF SOME COMMON MACROBENTHIC INVERTEBRATES. Trans. Amer. Fish. Soc., 101(4): 743-746.

The preservatives, 10% formalin (4% formaldehyde), 70% ethanol with 5% glycerine, and 70% isopropanol with 5% glycerine, cause a great loss of wet and dry weight of worms and midge larvae. Subsequent observations have shown that preservation in alcohol solutions without glycerine results in similarly great losses in weight. It seems obvious that many of the published weight determinations and estimates of standing crop based on work with preserved organisms are practically useless.

15697. Umminger, Bruce L., and John B. Mahoney (Dept. of Biol. Sci., Univ. of Cincinnati, Cincinnati, Ohio 45221). 1972. SEASONAL CHANGES IN THE SERUM CHEMISTRY OF THE WINTER FLOUNDER, Pseudopleuronectes americanus. Trans. Amer. Fish. Soc., 101(4): 746-748.

Seasonal differences were found in four of eight blood characteristics measured in winter flounder. Serum osmolality was approximately 5% higher in winter fish, whereas serum sodium and chloride concentrations were unchanged. Serum potassium and protein levels were significantly lower in winter fish. Although the red blood cell count and hematocrit were unaffected by season, the hemoglobin levels were significantly lower in winter fish. This indicates that the amount of hemoglobin per red blood cell decreased in winter even though the absolute number of erythrocytes remained constant. The seasonal changes are presumably unrelated to temperature. It seems unlikely that sexual maturation is responsible for the increased serum osmolality in winter fish. Other seasonal factors that might be involved are photoperiod and the availability of food, but the effect of such conditions on serum osmolality has yet to be established.

15698. Roberts, Raymon F., and Herbert E. Allen (Dept. of Environmental and Industrial Health, School of Public Health, The Univ. of Mich., Ann Arbor, Michigan 48104). 1972. THE CONTROL OF pH AND TOTAL ALKALINITY OR TOTAL CARBONATE IN AQUATIC BIOASSAYS. Trans. Amer. Fish. Soc., 101(4): 752-756.

We have employed basic chemical equilibrium concepts to develop a method for precise control of pH and total alkalinity or total carbonate for use in bioassay studies. By precision control of these variables along with control of other variables, e.g., temperature, hardness, dissolved oxygen, and dissolved organics, determination of the quantitative effects of these variables on the toxicity of heavy metals is possible. (Authors conclusions)

15699. Duronslet, Marcel J., James M. Lyon, and Frank Marullo (NMFS, Biol. Lab., Galveston, Texas 77550). 1972. VERTICAL DISTRIBUTION OF POST-LARVAL BROWN, Penaeus aztecus, AND WHITE, P. setiferus, SHRIMP DURING IMMIGRATION THROUGH A TIDAL PASS. Trans. Amer. Fish. Soc., 101(4): 748-752.

15700. Nepszy, Stephen J., and A. O. Dechtiar (Ont. Min. Nat. Res., Lake Erie Fish. Res. Station, Wheatley, Ontario, Canada). 1972. OCCURRENCE OF Glugea hertwigi IN LAKE ERIE RAINBOW SMELT (Osmerus mordax) AND ASSOCIATED MORTALITY OF ADULT SMELT. J. Fish. Res. Bd. Canada, 29(11): 1639-1641.

The occurrence of cysts of Glugea hertwigi, a microsporidian parasite, in Lake Erie rainbow smelt (Osmerus mordax) has been monitored since 1960 when it was first recorded. Annual sampling has shown that an increasing proportion (up to 87.5% in 1971) of the smelt population has been infected. An unusually severe mortality among adult smelt occurred during early May, 1971, in western and west central Lake Erie. Sampling of dead and obviously stressed smelt revealed that 97.3% of the males and 76.7% of the females were heavily loaded with cysts in the intestines and gonads, respectively. It is suggested that the parasite load contributed to the unusual severity of the normal post spawning mortality. (Authors)

15701. Whitear, Mary (Dept. of Zool., Univ. College, London, England). 1971. THE FREE NERVE ENDINGS IN FISH EPIDERMIS. Journal of Zoology, 163(2): 231-236.

Electron micrographs are presented to show the appearance of nerve fibers in the epidermis of teleost fish, most of which are believed to come to free endings. Nerve fibres are wrapped for part of their course in the borders of epithelial cells. There is little morphological change in the nerves as they run in the epidermis, but their fibrillar structure becomes less organized as the end is approached. Many of the nerve fibres are varicose, with mitochondria accumulated in the varicosities. Many fibres contain vesicles, and some contain bodies with an electron-dense core. Nerve fibres have not been seen to reach the surface of the epithelium, although they may reach to within half a micrometre of the surface in some places. Most of the superficial nerve fibres run between or below the outer layer of epithelial cells. (Auth.)

15702. Whitear, Mary (Dept. of Zool., Univ. College, London, England). 1971. CELL SPECIALIZATION AND SENSORY FUNCTION IN FISH EPIDERMIS. Journal of Zoology, 163(2): 237-264.

Electron microscopy has been used to identify isolated chemosensory cells scattered in the oral epithelium and in the external epidermis of four teleosts. These cells are regarded as chemosensory because they closely resemble the gustatory cells of the taste buds in each species. Nerve fibres are associated with the bases of the scattered chemosensory cells, but synaptic modifications have not been found. Since such cells are found on the head and body of fish without external taste buds, it is assumed that on the body they are innervated from spinal nerves and hence belong to the common chemical sense. (Auth.)

15703. Wildish, D. J., and S. M. Polar (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. AN ACTOGRAPH FOR LATERALLY OR VENTRALLY COMPRESSED AQUATIC ORGANISMS OF MEDIUM SIZE. Fish. Res. Bd. of Canada Technical Report No. 341, 14 p. + appendices.

An actograph is described capable of recording spontaneous locomotor activity as distance travelled, turning frequency and swimming velocity of fish or crustaceans 5-50 cm long. The infrared-photosensing light switches and recording method are relatively trouble-free, applicable to a range of freshwater and marine organisms and cheap to construct. (Authors)

15704. Uyeno, T., and R. R. Miller (Museum of Zool., The Univ. of Michigan, Ann Arbor, Michigan 48104). 1972. SECOND DISCOVERY OF MULTIPLE SEX CHROMOSOMES AMONG FISHES. Experientia, 28(2): 223-225.

In a Mexican fish species not previously described, 41 autosomes are found in males and 42 in females. The findings support a system of multiple sexual chromosomes of this fish.

15705. Bailey, Reeve M., and Ted M. Cavender (Museum of Zool., The Univ. of Mich., Ann Arbor, Michigan 48104). 1971. FISHES. Reprinted from the McGraw-Hill Encyclopedia of Science and Technology, 3rd edition. Copyright McGraw-Hill Book Co., 34 p., illus.

This booklet comprises reprints of most of the articles treating the classification of fishes, especially bony fishes, that appeared in the McGraw-Hill Encyclopedia of Science and Technology, third edition, issued early in 1971. These articles discuss groups (orders and higher taxa) of fishes and fishlike vertebrates and, except for the first five, deal wholly or in part with the bony fishes (Osteichthyes).

15706. Fried, Bernard, David A. Foley, and Kathryn C. Kern (Biol. Dept., Lafayette Coll., Easton, Pennsylvania). 1970. In Vitro AND In Vivo EXCYSTATION OF Clinostomum marginatum (TREMATODA) METACERCARIAE. Proc. of The Helminthological Society of Washington, 37(2): p. 222.

15707. Smith, G. R., and J. G. Lundberg (Museum of Paleontology and Museum of Zool., The Univ. of Mich., Ann Arbor, Michigan 48104). 1972. THE SAND DRAW FISH FAUNA. Bull. American Museum of Natural History, No. 148, pp. 40-54.

Fish remains from the Sand Draw local fauna represent at least nine species in eight families. None of the fossils belongs to an evolutionary line unrepresented on the Plains today. The amount of morphological change between species of the Sand Draw local fauna and their recent counterparts is measurable in two cases and negligible in a third for which adequate samples are in hand. The systematic account of the identified fossils is followed by a brief discussion of environmental implications. (Authors)

15708. Peterson, Arthur R. 1972. WATER TRANSPARENCY IN MINNESOTA'S FISH AND GAME LAKES. Minn. Dept. of Natural Resources, Div. of Game and Fish, Technical Services Section, Special Publication No. 92, 9 p. + 12 figs.

The median secchi disc reading in all fish lakes was about 8 feet--5.5 feet in the southern lakes and 8.5 feet in the northern lakes. Water transparency (average secchi disc reading) for the various types of lakes is as follows: Lake trout lakes 16.1 feet, stream trout lakes 10.8 feet, walleye and centrarchid lakes 7.8 feet (range 5.7 to 9.0 feet), marginal lakes 4.0 feet (range 2 to 5 feet), and game lakes 3.5 feet. Plankton bloom lakes usually have a water transparency of less than 3 feet. Twenty-two percent of the lakes had brown bog stained water (dystrophic lakes) and 28 percent had algal bloom and silt problems. In shallow lakes with a water transparency less than 3 feet, submerged aquatic plant communities deteriorate or are absent and algae predominates. In the southern part of the state water transparency is highest from September through May. From June until mid-July, the transparency decreases and remains low until September when it begins to increase. In fish lakes, the amount of water shallower than 15 feet is usually less than 75 to 80 percent of the total area. When the amount of shallow water in a fish lake is higher than 75 to 80 percent, winter oxygen levels are probably maintained by inflowing water. (Auth.)

15709. Kaesler, Roger L., and John Cairns, Jr. (Dept. of Geol., The Univ. of Kansas, Lawrence, Kansas 66044). 1972. CLUSTER ANALYSIS OF DATA FROM LIMNOLOGICAL SURVEYS OF THE UPPER POTOMAC RIVER. Reprint from The American Midland Naturalist, 88(1): 56-67.

In a study of data from limnological surveys of a portion of the upper Potomac River, cluster analysis and correlation coefficients have shown that redundancy exists in the data. Aquatic insects and, to a lesser extent, diatoms have distributions that most nearly represent the total biota. It is suggested that the study of these two groups and the exclusion of other algae, protozoans, other invertebrates and fish would significantly reduce the cost of such surveys without appreciably affecting the information they provide. (Authors)

15710. Stewart, Robert W. 1972. NEUTRALIZATION EXPERIMENTS. N. J. Dept. of Environ. Protection, Div. of Fish, Game and Shellfisheries, Miscellaneous Report No. 35, 21 p.

Ponds No. 1 and No. 2, Winslow Tract, were successfully neutralized through application of hydrated lime at the rate of approximately 160 pounds/acre foot. Also, the alkalinity was correspondingly increased in both ponds and by applying the relationship between total alkalinity and standing crop of fish developed for balanced lakes in New Jersey (Stewart, 1971), the increase in alkalinity (approximate) from 5 ppm to 10 ppm in Pond No. 1 and 5 ppm to 15 ppm in Pond No. 2, indicates a theoretical increase in standing crop of 100% (62 - 124 lbs./acre) for Pond No. 1 and 150% (62 - 158 lbs./acre) for Pond No. 2. The most critical period following neutralization was found to be the winter months and routine fall liming utilizing crushed limestone at a rate of 45 lbs/acre foot was found to be satisfactory in maintaining the pH within the desired range (6.0-7.0). Largemouth bass were successfully introduced into both ponds following neutralization along with redear sunfish in Pond No. 2. These centrarchids, along with pumpkinseed sunfish (source unknown) which became established in both ponds were able to provide and maintain limited populations for angling. (Auth.)

15711. Hewitt, G. C. (Zool. Dept. Victoria Univ., Wellington, New Zealand). 1972. HYGIENE IN NEW ZEALAND TROUT HATCHERIES. N. Z. Marine Dept. Fisheries Technical Report No. 86, 12 p.

Includes: The nature of infectious disease and its transmission in fish; Parasites in New Zealand trout and salmon; The most likely avenues of infection for hatchery stocks; Measures which may be taken to decrease the risk of initial infection; The course of infections in hatcheries; Preventing disease build-up in hatcheries; Methods of disinfection, (1) steam cleaning and (2) chlorination; Keeping records. (From Contents)

15712. Rafail, S. Z. (Inst. of Oceanogr. and Fish.; Kayed Bey, Alexandria, Egypt). 1972. FITTING A PARABOLA TO GROWTH DATA OF FISHES AND SOME APPLICATIONS TO FISHERIES. Marine Biology, 15(3): 255-264.

Denoting a fish length or weight at age t by X_t, a reference age by t_m, and the corresponding fish length or weight by X_m, the relation between age and length or weight may be described by a parabola as follows:

$|X_t - X_m| = a + b(|t - t_m|) + c(|t - t_m|)^2$ or

$X_t = A + b(|t - t_m|) + c(|t - t_m|)^2$ where a, b and c are constants. Each of the above Eqs. describes one curve at ages older than t_m and another one at younger ages, which is made possible by means of the transformation of t to $(t - t_m)$. In 2 cases out of 10, the parabola takes the form of a cubic equation. Evidence is given that, as the growth data become fewer, the better fit of the parabola or cubic equation will probably be less in comparison to the Von Bertalanffy equation (1938, 1949) as developed by Beverton and Holt (1957) and the power-growth equation (Rafail, 1971), and vice versa. The growth equation is used to derive models for estimating the optimum age and yield for fish populations. (Auth.)

15713. Berra, Tim M., and Gerald E. Gunning (Dept. of Biol., Tulane Univ., New Orleans, Louisiana). 1972. SEASONAL MOVEMENT AND HOME RANGE OF THE LONGEAR SUNFISH, Lepomis megalotis (Rafinesque) IN LOUISIANA. Amer. Midl. Nat., 88(2): 368-375.

The movements of longear sunfish, Lepomis megalotis, in the headwaters of three Louisiana streams were studied by electrofishing and mark-recapture techniques. A total of 352 fish were marked by fin-clipping and 72 recaptures were made over a 31-month period. Fifty-one recaptures (71%) were within the stream sections where they were marked (average length 42 m). This coincides well with data of other workers who estimated home ranges of 21-61 m for this species. During the warmer months (April-October) 337 fish (average T. L. of 90 mm) were taken in the marking section, but in winter (November-March) only 124 fish (average T. L. of 73 mm) were taken in the same sections. The sunfish appeared to desert their home ranges in winter. (Authors)

15714. Reisen, William K. (Dept. of Entomol. and Zool., Clemson Univ., Clemson, South Carolina). 1972. THE INFLUENCE OF ORGANIC DRIFT ON THE FOOD HABITS AND LIFE HISTORY OF THE YELLOWFIN SHINER, Notropis lutipinnis (Jordan and Brayton). Amer. Midl. Nat., 88(2): 376-383.

Recent investigations of invertebrate drift have suggested a food chain relationship between riffle-dwelling benthos and lotic fishes, with draft acting as a transport mechanism facilitating predation. A year-long study of the yellowfin shiner, Notropis lutipinnis (Jordan and Brayton), in Praters Creek, Pickens Co., South Carolina, has shown that significant synchronization exists among drift, fish-feeding activity and spawning. A qualitative and quantitative evaluation of adult stomach contents suggested that the drifting invertebrates were oonsumed in quantities proportional to their composition by weight in the drift. Cyprinidae fry drifted during May when the total invertebrate drift was highest. Drifting fry exhibited a marked nocturnal periodicity with the greatest numbers recovered between 0330 and 0530 AM. (Auth.)

15715. Simmons, George M., Jr. (Dept. of Biol., Va. Commonwealth Univ., Richmond, Virginia). 1972. A PRE-IMPOUNDMENT STUDY OF THE NORTH ANNA RIVER, VIRGINIA. VPI-WRRC-BULL 55, 76 p., illus.

15716. Woodall, W. Robert, Jr., and J. Bruce Wallace (Dept. of Entomol., Univ. of Georgia, Athens, Georgia). 1972. THE BENTHIC FAUNA IN FOUR SMALL SOUTHERN APPALACHIAN STREAMS. Amer. Midl. Nat., 88(2): 393-407.

Monthly quantitative samples of benthic organisms were collected from streams in four different watersheds from August 1968 through July 1969. Each of the watersheds supports one of the following types of vegetation: old-field succession, hardwood forest, white pine forest with a few hardwoods, coppice forest. The kinds of organisms in the four streams were generally similar but their relative importance varied significantly. A Duncan's multiple-range test showed significant differences in the numbers of most taxa among the watersheds. The old-field stream had the greatest abundance while the coppice stream had the greatest standing crop biomass. The white pine stream had lowest standing crops of both numbers and biomass. Most of the differences among watersheds were attributed to different inputs of allochthonous detritus. (Authors)

15717. Peterka, John J. (Dept. of Zool., No. Dakota State Univ., Fargo, North Dakota). 1972. BENTHIC INVERTEBRATES IN LAKE ASHTABULA RESERVOIR, NORTH DAKOTA. Amer. Midl. Nat., 88(2): 408-418.

The kinds and amounts of benthic invertebrates in Lake Ashtabula, a 20-year-old eutrophic reservoir in southeastern North Dakota, were recorded at a single station located 3.2 km N of the dam. The average standing crops of benthic invertebrates in the sampling station collected during April, June and August 1967 were 6.4, 8.2 and 7.1 g m^{-2}, respectively, and 1831, 2622 and 1795 individuals m^{-2}. Organisms in the 0-3 m depth zone accounted for 28% by number and 53% by weight of all organisms present in the study area from April to August; 56% by number and 37% by weight were in the 3-8 m depth zone; and 16% by number and 9% by weight were in the 8-12 m depth zone. The quantity and kinds of its benthic invertebrates indicate Lake Ashtabula is eutrophic when compared with data available from other lakes that are also unstratified during openwater periods. (Auth.)

15718. Howse, Harold D. (Section of Microscopy, Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1972. SNOOK (CENTROPOMUS: CENTROPOMIDAE): NEW HOST FOR LYMPHOCYSTIS, INCLUDING OBSERVATIONS ON THE ULTRASTRUCTURE OF THE VIRUS. Amer. Midl. Nat., 88(2): 476-479.

Lymphocystis disease is reported in a new host species and family (Centropomus undecimalis (Bloch): Centropomidae). The pathognomonic hyaline capsule surrounding each tumor cell is PAS positive, alcianophilic, and three to four times thicker than those previously reported. The virions are icosahedral in shape and range from 237 to 250 nm in diam. Each has a nucleoid of about 180-190 nm in diam. consisting of a ball of osmiophilic threads having cross-sectional diam. of about 3 nm.

15719. Buhan, Paul J. (Box F 202, Biol. Dept., Shippensburg State Coll., Shippensburg, Pennsylvania). 1972. THE COMPARATIVE OSTEOLOGY OF THE CAUDAL SKELETON OF SOME NORTH AMERICAN MINNOWS (CYPRINIDAE). Amer. Midl. Nat., 88(2): 484-490.

The caudal skeletons of 34 species and subspecies representing 14 genera of North American cyprinids were examined and found not to vary markedly. Contrary to previous reports, there are usually four hypurals in the upper lobe of the caudal fin. Most aspects of the tail skeleton make little taxonomic or adaptive sense, although some characteristics may be of taxonomic value when used in conjunction with features from other skeletal regions. Bones are infrequently absent and fusions are rare. Except for the consistent absence of the third urodermal in Notemigonus crysoleucas, Semotilus corporalis and Semotilus atromaculatus, the loss and fusion of bones are intraspecifically variable. Depressed neural and hemal spines, the degree of development of median plates and processes, and the splitting and doubling of neural arches and spines do not seem to correlate too well with the depth of the caudal peduncle. (Auth.)

15720. Hoff, James G. (Southeastern Massachusetts Univ., North Dartmouth, Massachusetts). 1972. MOVEMENTS OF ADULT TIDEWATER SILVERSIDE, Menidia beryllina (Cope), TAGGED IN NEW ENGLAND WATERS. Amer. Midl. Nat., 88(2): 499-502.

Adult Menidia beryllina were tagged with "Tracer Glow Pigments" in the Slocum River in southeastern Massachusetts. The tagging data support the hypothesis that M. beryllina has a relatively small home range within the estuary. (Auth.)

15721. Putz, Robert E. (Bur. of Sport Fish. & Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia). 1972. BIOLOGICAL STUDIES ON THE HEMOFLAGELLATES Cryptobia cataractae AND Cryptobia salmositica. Tech. Papers of the Bur. of Sport Fish. & Wildl., No. 63, 25 p., illus.

Studies on two hemoflagellates of fish, Cryptobia cataractae Putz and C. salmositica Katz, were carried out to determine biological parameters: host range, vector relations, in vivo culture, in vitro culture, pathogenicity, and cryogenic preservation. In nature the host range of C. cataractae is limited to the fish family Cyprinidae, while C. salmositica is found in the families Salmonidae, Cyprinidae, Cottidae, and Gasterosteidae. In comparative experimental host range studies by inoculation, C. salmositica infected eight species of fishes from three families; C. cataractae infected three species from two families. Cryptobia-infected leeches, Cystobranchus virginicus, parasitized Cryptobia-infected longnose dace, Rhinichthys cataractae. The Cryptobia from these leeches was transmitted by inoculation to susceptible fishes and found to be C. cataractae, proving a vector-host relationship. These leeches were specific in nature for R. cataractae. In vivo culture of C. cataractae and C. salmositica was carried out successfully in the laboratory for 1 year, after which the organisms were maintained by cryogenic preservation. In vitro culture attempts failed. A comparative experimental pathology study based on infection by inoculation showed C. salmositica to be very pathogenic to one of its natural hosts, coho salmon, Oncorhynchus kisutch, producing clinical symptoms of disease and total mortality. C. cataractae, injected into one of its natural hosts, blacknose dace, R. atratulus, failed to produce any clinical symptoms of disease or mortalities. C. cataractae and C. salmositica were successfully preserved cryogenically for 3 years; best survival rates were attained with glycerol as the adjuvant at a concentration of 10 percent. (Auth.)

15722. Rawson, Mac V., and Wilmer A. Rogers (Dept. of Fish. and Allied Aquaculture, Agric. Exper. Sta., Auburn Univ., Auburn, Alabama). 1972. THE SEASONAL ABUNDANCE OF THE ANCYROCEPHALINAE (MONOGENEA) ON LARGEMOUTH BASS IN WALTER F. GEORGE RESERVOIR. Proc. Helm. Soc. Wash., 39(2): 159-162.

Four species of Ancyrocephalinae were collected from largemouth bass in Walter F. George Reservoir from December 1967 to January 1969. The abundance of Urocleidus principalis and U. furcatus peaked at 28 C in June and mid-September, declined in the early fall, and then rose to another peak in December at 9 C. The abundance of Actinocleidus fusiformis peaked prior to the spring period of maximum temperature change in June and mid-September at 28 C and in December at 9 C. Abundance of Clavunculus bursatus peaked in the early spring and late fall at 9 C. The peaks of abundance seemed to be a water temperature-associated phenomenon. (Authors)

15723. Christian, Frederick A. (Fac. of Zool., Ohio State Univ., Columbus, Ohio). 1972. Spinitectus micracanthus sp. n. (NEMATODA: RHABDOCHONIDAE) FROM THE BLUEGILL, Lepomis macrochirus Rafinesque, IN OHIO. Proc. Helm. Soc. Wash., 39(1): 51-54.

Spinitectus micracanthus sp. n. is described from the intestine of Lepomis macrochirus. It differs from all other species of the genus in having a male with two parallel longitudinal rows of cuticular ridges anterior to the anus. The species most closely resembles S. carolini Holl, 1928, from which it differs in ratios of anatomical structures, number and type of cuticular spines, cuticular ridges; number of, and arrangement of postanal papillae; shape and size of long spicule; size of the females and eggs. (Auth.)

15724. Meyer, Marvin C., and Rolf Vik (Dept. of Zool., Univ. of Maine, Orono, Maine). 1972. FINAL HOSTS OF Diphyllobothrium sebago (CESTODA: PSEUDOPHYLLIDEA) IN NATURE. Proc. Helm. Soc. Wash., 39(1): 1-4.

In an examination of 322 piscivorous birds (11 spp.) and 23 mammals (6 spp.), from the Rangeley Lakes region in western Maine, where Diphyllobothrium sebago (Ward) is enzootic, only the herring gull (Larus argentatus Pontoppidan) was found to be of epizootological importance. The ecological relationship between the final avian host and the intermediate fish hosts is discussed. (Authors)

15725. Putz, Robert E. (Bur. of Sport Fish. & Wildl., Eastern Fish Disease Lab., Kearneysville, West Virginia). 1972. Cryptobia cataractae sp.n. (KINETOPLASTIDA: CRYPTOBIIDAE), A HEMOFLAGELLATE OF SOME CYPRINID FISHES OF WEST VIRGINIA. Proc. Helm. Soc. Wash., 39(1): 18-22.

Cryptobia cataractae sp. n. is described from the blood of some cyprinid fishes of West Virginia. The leech vector is Cystobranchus virginicus. It is compared with the Cryptobia species found in the blood of North American freshwater fishes. (Auth.)

15726. Stromberg, Paul C., and John L. Crites (Dept. of Zool., Ohio State Univ., Columbus, Ohio). 1972. A NEW NEMATODE Dichelyne bullocki sp. n. (CUCULLANIDAE) FROM Fundulus heteroclitus (Linnaeus). Proc. Helm. Soc. Wash., 39(1): 131-134.

Dichelyne bullocki sp. n. is described, figured, and compared with other species of the genus Dichelyne Jägerskiöld, 1902, from North American fishes. The history of the species group designated as D. lintoni is briefly reviewed. D. bullocki and D. fastigatus are the only species of marine Dichelyne from North American waters which are adequately described. (Authors)

15727. Colombo, Lorenzo, Howard A. Bern, and Julie Pieprzyk (Dept. of Zool., and its Cancer Res. Genetics Lab., Univ. of Calif., Berkeley, California). 1971. STEROID TRANSFORMATIONS BY THE CORPUSCLES OF STANNIUS AND THE BODY KIDNEY OF Salmo gairdnerii (TELEOSTEI). General and Comparative Endocrinology, 16(1): 74-84.

The corpuscles of Stannius and the body kidney of the rainbow trout, Salmo gairdnerii, convert in vitro at 11.5° progesterone-4-^{14}C into labeled 11-deoxycorticosterone, 5α-pregnanedione, and 5β-pregnanedione, in addition to a number of unknown metabolites. Steroids were identified by their mobilities on thin-layer chromatograms, derivative formation, and recrystallization to constant specific activity with corresponding authentic preparations. Comparison of the product yield-time curves indicates that, under identical conditions, the amount of 11-deoxycorticosterone formed in the incubates of body kidney was at least six times greater than in those of Stannius corpuscles. More 5β-pregnanedione than 5α-pregnanedione was produced by the kidney, whereas the converse occurred with the Stannius corpuscles, 11β- and 17α-Hydroxylase activities were absent in both tissues, and steroid conjugation was also not observed. On the basis of these findings, any assignment of distinctive corticosteroidogenic function to the corpuscles of Stannius of the rainbow trout seems unjustified. (Authors)

15728. Mukhamedov, S. M., M. V. Inzhevatova, A. F. Aleinikova, N. M. Ostrovskaya, and T. R. Radzhapov. 1971. LAKE FROGS, FISH AND WATER CRAYFISH AS POTENTIAL RETAINERS OF VIBRIOS IN NATURE. Zh. Mikrobiol. Epidemiol. Immunobiol., 48(1): 56-59, English summ.; Selected Water Resources Abstracts, 5(18): p. 16.

The role played by lake frogs, fish, and water crayfish (the usual inhabitants of open water bodies of Uzbekistan) in the preservation of certain representatives of Vibrio genus in nature was studied. Irrespective of the season, from 8 to 15.5% of these animals were spontaneously infected with vibrios of various groups after Heiberg. No manifest signs of disease or any lesions were revealed in the organs of infected frogs and fish. Lake frogs, fish and crayfish probably served as reservoirs of vibrios in nature. -- Copyright 1972, Biological Abstracts, Inc.

15729. Penzes, B. (Fovaros Allat-Novenykertje, Budapest, Hungary). 1971. THE EFFECT OF WATER TREATED WITH CHLORINE ON LIVING FISH. Allattini Koezl., 58(1-4): 87-89, illus; Selected Water Resources Abstracts, 5(18): p. 53, 1972.

Water with a Cl content of 0.15-0.4 mg/l kills native European freshwater fish. It destroys the respiratory wall epithelium of the gills. The construction of a dechlorification apparatus, its filter layers and capacity are discussed. -- Copyright 1972, Biological Abstracts, Inc.

15730. Aitken, A. (Nottingham Univ., Dept. of Zool., England). 1971. THE EFFECTS OF TEMPERATURE AND DIET ON ASPECTS OF THE PHYSIOLOGY OF THE RAINBOW TROUT - Salmo gairdnerii. In: Symposium on Freshwater Biology and Electric Power Generation, Part 2, pp. 177-185, 5 fig. 3 ref.; Selected Water Resources Abstracts, 5(18): p. 62, 1972.

Earlier experiments showed that on a low fat diet the specific growth rate of rainbow trout decreased when the temperature was raised from 12 to 16 C, while the same increase in temperature on a high fat diet resulted in an increase in the specific growth rate. A change from a low fat to a high fat diet, the temperature being held constant at 12 C, caused a fall in ammonia excretion which continued over several weeks while the high fat diet was being fed to the fish. At the same time the specific growth rate was considerably increased. It appears that fat was more available to the fish at the higher temperature, and that fat replaced protein as a calorie source when the dietary fat was sufficient. This was indicated by the decrease in ammonia output and increase in specific growth rate. At various levels of activity, fish on the high fat diet have a lower oxygen consumption than those on the low fat diet. This might be explained by the fact that 4.686 K cal of energy are obtained from 1 liter of oxygen when fat is metabolized, compared with 4.485 K cal when protein is metabolized.

15731. May, R. C. (Scripps Inst. of Oceanogr., La Jolla, California). 1971. AN ANNOTATED BIBLIOGRAPHY OF ATTEMPTS TO REAR THE LARVAE OF MARINE FISHES IN THE LABORATORY. NOAA Technical Report NMFS SSRF-632, 24 p., 38 ref. For sale by the Supt. of Documents, U. S. Govt. Printing Office, Washington, D.C., price 35 cents; Selected Water Resources Abstracts, 5(18): p. 64, 1972.

This annotated bibliography covers 38 citations of literature from the period 1878 to 1969. All fish species studied in these attempts are listed in an appendix. The types of food used in the attempts are listed in a second appendix. An annotation with each entry in the bibliography provides information on the fish studied, foods used, type of container, water temperature, maximum time kept, maximum length reached by larvae, the survival rate, and additional remarks.

15732. Frantsi, C., and M. Savan (Mactaquac Fish Culture Sta., Fredericton, New Brunswick, Canada). 1971. INFECTIOUS PANCREATIC NECROSIS VIRUS: TEMPERATURE AND AGE FACTORS IN MORTALITY. J. Wildl. Dis., 7(4): 249-255, illus; Selected Water Resources Abstracts, 5(18): p. 68, 1972.

Infectious pancreatic necrosis virus was present in brook trout in 2 Ontario salmonid hatcheries but did not appear to cause high mortality. Experiments and field observations showed that a number of factors were responsible for the low mortality, in particular, low water temperatures during the age of highest susceptibility of the fry and a lack of, or low level of transmission of virus during these periods of cold water temperatures. -- Copyright 1972, Biological Abstracts, Inc.

15733. Chittenden, Mark E., Jr. (Dept. of Environ. Sci., Rutgers Univ., New Brunswick, New Jersey). 1971. TRANSPORTING AND HANDLING YOUNG AMERICAN SHAD. N. Y. Fish Game J., 18(2): 123-128, illus.

Procedures for successfully transporting and handling young American shad are described. Mortality frequently encountered in handling this species is attributed primarily to stress arising from excitement. (Auth.)

15734. Sparks, Richard E., John Cairns, Jr., and Alan G. Heath (Va. Polytech. Inst. and State Univ., Blacksburg, Virginia 24061). 1972. THE USE OF BLUEGILL BREATHING RATES TO DETECT ZINC. Water Research, Vol. 6, pp. 895-911.

The presence of zinc at concentrations of 8.7, 5.22, 4.16 and 2.55 mg l^{-1} in dechlorinated municipal tapwater was detected by an increase in breathing rate or a change in breathing rate variance of bluegills. None of the fish exposed to the three lower concentrations died during the experiments. The criterion for detection was an arbitrary number of responses occurring at the same time. When the criterion was changed from a single response to three responses occurring at the same time, the number of false detections ("detections" occurring before zinc addition) decreased, but the lag between zinc addition and detection increased. Zinc concentrations of 0.035 and 0.076 mg l^{-1} (approximately 1/75 and 1/34 of 2.55 mg l^{-1}, respectively) did not appear to affect the reproduction and growth of bluegills in the laboratory, but 0.235 mg l^{-1} zinc (approximately 1/10 of 2.55 mg l^{-1}) inhibited spawning in ripe bluegills and killed newly-hatched fry. An in-plant system for the prevention of fish kills caused by industrial spills probably could be developed by monitoring several biological functions of fish simultaneously to obtain informational redundancy and reduce error; by exposing test fish to higher waste concentrations than occur in the receiving stream as a safety factor; automating the collection and analysis of data to reduce lag time; and by choosing appropriate criteria for detection. (Authors)

15735. Pillay, K. K. S., C. C. Thomas, Jr., J. A. Sondel, and C. M. Hyche (Western N. Y. Nuclear Res. Center, State Univ. of N. Y. at Buffalo, Buffalo, New York). 1972. MERCURY POLLUTION OF LAKE ERIE ECOSPHERE. Environmental Research, 5(2): 172-181.

The distribution of mercury in the ecosphere of Lake Erie was monitored using a highly sensitive and reliable neutron activation analysis procedure. A variety of samples from the fauna and flora of the lake as well as those from its immediate environment were analyzed for their mercury content. The results of this survey indicate a widespread distribution of mercury in air particulates; coal samples of the region; sediments, plankton/algae and fish samples from the lake; and in the brain tissues of long-time residents of the Lake Erie Basin. (Authors)

15736. Snow, Howard E., and Thomas D. Beard. 1972. A TEN-YEAR STUDY OF NATIVE NORTHERN PIKE IN BUCKS LAKE, WISCONSIN INCLUDING EVALUATION OF AN 18.0-INCH SIZE LIMIT. Dept. of Natural Resources, Madison, Wisconsin Technical Bulletin No. 56, 20 p.

From 1961 to 1970, a population study of the northern pike, Esox lucius Linnaeus, was conducted on Bucks Lake where northern pike were the only predator species present. Growth of these fish was the slowest reported locally and among the very slowest, regionally. The average standing crop of northern pike 10 inches and larger was 24.4 lbs/acre. The maximum standing crop was 42.5 pounds per acre which is equivalent to the maximum standing crop found for other waters. The estimated annual fishing pressure for a three-year period was 19.7 hours per acre and the catch rate for all species was 1.0 fish per hour. Fifty-seven percent of all anglers were successful. Before the imposition of an 18.0-inch size limit, the catch of northern pike was 9.6 pike per acre, while after the size limit went into effect, only 1.1 pike per acre were caught. Before the 18.0-inch limit was set, 62 percent of the total catch of northern pike were under 18.0 inches. Average annual total mortality of pike was 64 percent, natural mortality was 37 percent and exploitation rate was 9 percent. These data suggest that mortality due to angling has little, if any, effect on total mortality. No northern pike tagged in Bucks Lake were captured in downstream areas despite intensive efforts to do so. It was concluded that use of an 18.0-inch size limit on northern pike was not biologically justified in Bucks Lake. (Authors)

15737. Beyerle, George B., and John E. Williams. 1972. CONTRIBUTION OF NORTHERN PIKE FINGERLINGS RAISED IN A MANAGED MARSH TO THE PIKE POPULATION OF AN ADJACENT LAKE. Mich. Dept. of Natural Resources, Research and Development Report No. 274, 20 p.

A yearly average of 4,827 marked fingerling northern pike were stocked from a managed marsh into a 289-acre adjacent lake for 3 consecutive years. Estimated mean yearly survival of these pike through fall of the first year was 1,339 (28%). Estimated mean yearly survival of naturally produced pike was 821, making a total of 2,160 young-of-the-year pike surviving to fall of each year. Growth of both stocked and naturally raised pike was well above Michigan state average:--after 3 years of growth, stocked pike averaged 3.5 inches longer than state average, and naturally raised pike averaged 2.1 inches longer. This rapid growth would indicate that the stocking rate of pike could be increased substantially with significant benefit to the fishery. We were unsuccessful in using Bergman-Jefferts magnetic tags to mark fingerling pike for long-term experiments. Although the tagging operation caused no obvious mortality, the inconsistency of response of supposedly tagged pike, when checked on the tag detector, was unexplained. (Authors)

15738. Moffler, Mark D. (Univ. of South Florida, Florida). 1972. PLASMONICS: COMMUNICATION BY RADIO WAVES AS FOUND IN ELASMOBRANCHII AND TELEOSTII FISHES. Hydrobiologia, 40(1): 131-143.

The phenomenon of fish communication, via hydronic radio waves, is both perplexing and important to the biologist. It has been found through my research that fish definitely possess the ability to produce hydronic radio waves. Hydronic signals are neither sonic nor electrical, but are receivable on a submerged dipole antenna. No signals are received in the absence of fish and each species emits signals characteristically different from other species in carrier frequency, pulse duration, and intensity. Incidence of signals per unit time varies with species of fish, tidal conditions, lighting conditions, and temperature conditions. (Auth. summ.)

15739. Hardy, C. J. (Fish. Div., Fish. Lab., Christchurch, New Zealand). 1972. QUINNAT SALMON INVESTIGATIONS - REVIEW OF INVESTIGATIONS OF TECHNICAL FIELD SERVICE OF THE COUNCIL OF SOUTH ISLAND ACCLIMATISATION SOCIETIES - FEBRUARY 1969. N. Z. Marine Dept. Fisheries Technical Report No. 84, 38 p., illus.

Quinnat salmon were introduced into New Zealand from California at the turn of the century and by the early 1920's good catches of quinnat were being reported from all the major South Island east coast rivers from the Waiau to the Clutha. The utilisation and present status of quinnat salmon stocks is described. The paper reviews the progress of investigations being undertaken by the Technical Field Service of the Council of South Island Acclimatisation Societies principally on the Glenariffe Stream which is a tributary of the Rakaia River. (Auth. summ. in part).

15740. Rawley, Edwin V. 1972. STATISTICAL DATA CONCERNING UTAH HUNTING AND FISHING LICENSE BUYERS. Utah State Dept. of Natural Resources Publication No. 72-4, 144 p.

This study consists of two parts. Part I concerns the key punching on data processing cards of certain information regarding all persons who purchased a 1969 Utah fish and game license. These data were correlated with 1970 census data. Part II deals with a random sample questionnaire mailed to Utah residents who purchased a 1969 fish and game license requesting information on hunting and fishing preferences. Part I, then, deals with license buyer characteristics and Part II with license buyer preferences. Part II is divided into five phases. Phase one concerns hunting and fishing activities of combination license holders; phase two concerns hunting activities of small game license buyers; phase three deals with fishing activities of fishing license buyers; phase four is a correlation of phases one, two and three concerning the combined hunting and fishing activities of combination, small game and fishing license holders; and phase five deals with hunting activities of combination and deer license buyers. The 1969 license year

was used in both parts of this study so that the data could be correlated with 1970 census data. The Utah 1969 fish and game license year began on April 16, 1969 and ended on April 15, 1970. The United States census day, April 1, 1970, is included in this license-year period. Phase one of Part II was written before the 1970 census figures for Utah were available; therefore, estimated 1970 county population figures are used. (Auth. introduction)

15741. Johnson, Fritz H. 1971. SURVIVAL OF STOCKED WALLEYE FINGERLINGS IN NORTHERN MINNESOTA LAKES AS ESTIMATED FROM THE AGE-COMPOSITION OF EXPERIMENTAL GILL NET CATCHES. Minn. Dept. of Nat. Resources Investigational Report No. 314, 12 p.

No increase in relative abundance of stocked year-classes or walleye populations could be found for 28 Northern Minnesota walleye lakes as a result of 2 to 4 year rotational midsummer plants of walleye fingerlings averaging 1,380 per pound. Average stocking rate was 135 fingerlings per littoral acre (area to 15 foot depth). Walleye year-classes and populations in bass-panfish lakes where walleye reproduction is poor apparently were increased by midsummer stocking of fingerlings averaging 977 per pound at an average rate of 162 per littoral acre. (Auth.)

15742. Wolf, Ken (Bur. Sport Fish. & Wildl., Eastern Fish Dis. Lab., Kearneysville, West Virginia). 1972. ADVANCES IN FISH VIROLOGY: A REVIEW 1966-1971. Symp. zool. Soc. Lond. No. 30, pp. 305-331.

This is a review of progress in the virology of teleost fish during the period 1966 to 1971. Introductory material includes a brief history and some generalizations on fish viruses. There are two sections for the viruses which have been isolated - one for those presumed to contain ribonucleic acid (RNA) and another for those with deoxyribonucleic acid (DNA). Certain diseases and neoplasms are considered as possibly having a viral aetiology because there are epidemiological or experimental data to suggest such a cause; three diseases in this group are included in the discussion. Electron microscopy has shown viruses to be associated with five different neoplasms of fish, and a separate section is devoted to this work. A closing section discusses plaque assay of virus and its advantages in diagnostic procedures. (Auth. synopsis)

15743. Beyerle, George B., and John E. Williams. 1972. SURVIVAL, GROWTH, AND PRODUCTION BY BLUEGILLS SUBJECTED TO POPULATION REDUCTION IN PONDS. Mich. Dept. of Natural Resources Research and Development Report No. 273, 28 p.

Survival, growth, and production of bluegills, in populations subjected to yearly reduction were studied in three large, adjacent ponds at Belmont. In Pond 1 (control) the mean standing crop in fall during the 5-year study was 324 kg/ha; in Pond 2 (60% yearly reduction of young-of-the-year bluegills) it was 226 kg/ha; and in Pond 3 (90% yearly reduction of young-of-the-year bluegills), 249 kg/ha. Mean yearly reduction in total standing crop was 4% (handling loss) in Pond 1, 33% in Pond 2, and 38% in Pond 3. Survival of young-of-the-year bluegills in Pond 1 was very low (mean of 0.5% per year), compared to survival of young in Pond 2 (mean of 8.1% per year) and Pond 3 (12.2% per year). No correlation occurred between calculated egg production and number of young bluegills surviving to fall. Growth of bluegills in all three ponds was very similar; it was also slow, averaging over 25 mm (1 inch) less than the statewide average for Michigan. Mean total yearly production on Ponds 2 and 3 was similar, and averaged 31% more than in Pond 1. Production by young-of-the-year bluegills in Pond 1 was only 27% of total production, compared with a mean of 58% for Ponds 2 and 3. Pond 1 outdid the other ponds in production by year classes other than young-of-the-year. During the study, the number of catchable bluegills per hectare increased from 45 to 351 in Pond 1, decreased from 144 to 126 in Pond 2, and decreased from 169 to 10 in Pond 3. Results of this study suggest that one way to produce larger and faster-growing bluegills in lakes where growth is slow is to keep the bluegill population substantially unbalanced by yearly removal of as much as 50% of the older bluegills, while cropping each new year class down to a level below 10,000 bluegills per hectare. (Authors)

15744. Schubel, J. R., and E. W. Schiemer (Chesapeake Bay Inst., The Johns Hopkins Univ., Baltimore, Maryland 21218). 1972. A DEVICE FOR COLLECTING IN-SITU SAMPLES OF SUSPENDED SEDIMENT FOR MICROSCOPIC ANALYSIS. Reprint from Sears Foundation: Journal of Marine Research, 30(2): 269-273.

An in-situ sampler for collecting small samples of suspended sediment for microscopic analysis has been built and tested. The device rapidly freezes a thin layer of water entrapping all of the suspended particules in it; when the sampler is recovered, the disc of ice is placed on a suitable substrate and freeze-dried. The particles can then be examined in an undisturbed state with a light microscope or with an electron microscope. (Authors)

15745. Gomez, Ricardo, and Hague L. Lindsay, Jr. (Okla. Fishery Res. Lab., Norman, Oklahoma). 1972. OCCURRENCE OF THE MISSISSIPPI SILVERSIDES, Menidia audens (Hay), IN KEYSTONE RESERVOIR AND THE ARKANSAS RIVER. Proc. Okla. Acad. Sci. 52: 16-18.

The Mississippi silversides, Menidia audens, was first encountered in the main stream of the Arkansas River below Keystone Reservoir in May 1970 and in the reservoir proper in September 1971. Seine sampling in October 1971 revealed an established population of M. audens in Keystone Reservoir. M. audens may have replaced the brook silversides, Labidesthes sicculus, in Keystone Reservoir paralleling the succession that took place in Lake Texoma in 1957 as reported by Riggs and Bonn in 1959. (Authors)

15746. Kelly, Russell K., and Philip C. Loh (Virus Lab., Dept. of Microbiol., Univ. of Hawaii, Honolulu, Hawaii). 1972. ELECTRON MICROSCOPICAL AND BIOCHEMICAL CHARACTERIZATION OF INFECTIOUS PANCREATIC NECROSIS VIRUS. Journal of Virology, 10(4): 824-834.

An electron microscopical and biochemical examination of the properties of infectious pancreatic necrosis virus (IPN) and of its ribonucleic acid (RNA) was made. The buoyant density of IPN in CsCl was found to be 1.33 g/cm^3. Electron microscopical examination of the banded virus revealed structures similar in size (74 nm) and shape to reoviruses but lacking a characteristic inner capsid structure. Polyacrylamide gel electrophoretic analysis of IPN-RNA revealed a single non-segmented component of molecular weight 3.2 X 10^6. Its susceptibility to ribonuclease, base composition, and resistance to thermal denaturation indicated a single-stranded RNA structure. However, its sedimentation behavior (16S) independent of ionic strength in sucrose gradients, partial solubility in 2M LiCl, and ribonuclease resistance in the presence of Mg^{2+} suggest an unusual secondary structure of unknown nature. The accumulated data indicate that IPN virus does not belong to either the picornavirus or reovirus groups and may represent a new group of viruses. (Authors)

15747. Johnson, Donald W. (Dept. of Zool., Ariz. State Univ., Tempe, Arizona). 1972. VARIATIONS IN THE INTERRENAL AND CORPUSCLES OF STANNIUS OF Mugil cephalus FROM THE COLORADO RIVER AND ITS ESTUARY. General and Comparative Endocrinology, 19(1): 7-25.

The interrenal and corpuscle of Stannius tissue from a natural population of striped mullet (Mugil cephalus) were examined in an attempt to correlate tissue activity with environmental variables, primarily salinity. The interrenal tissue of the striped mullet consists of anastomosing "tubulelike" cylindrical cords folded upon themselves. The pseudolumina within the cell cords were most distinctive in the freshwater population. Interrenal cell nuclear diameter and character, as well as the nature of the cytoplasm, indicated greater interrenal activity in fresh water. Seasonal variation was present. The corpuscles of Stannius consist of extensively folded cylindrical cell cords, often as an anastomosing mass. Corpuscle activity, as indicated by relative cytoplasmic abundance and by nuclear orientation, shape and size, was greater in saltwater than in freshwater mullet. Corpuscle activity was greatest in August and December. Mullet with pathological symptoms possessed corpuscles that differed significantly from those of apparently healthy fish. The activity of both interrenal tissue and

corpuscles of Stannius of striped mullet seems closely related to environmental factors. The influence of temperature and increased gonadal activity in stimulation of interrenal tissue appears conclusive. On the basis of histological evaluation an osmo (iono) regulatory role for the interrenal organ is strongly supported, and a relationship between corpuscle of Stannius activity and osmoregulation is also probable. (Auth.)

15748. Louie, Andrew J., and Gordon H. Dixon (Dept. of Biochem., The Univ. of British Columbia, Vancouver 8, British Columbia, Canada). 1972. TROUT TESTIS CELLS. I. CHARACTERIZATION BY DEOXYRIBONUCLEIC ACID AND PROTEIN ANALYSIS OF CELLS SEPARATED BY VELOCITY SEDIMENTATION. J. Biol. Chem., 247(17): 5490-5497.

Trout testis cells at different stages of spermatogenesis were separated by velocity sedimentation on serum albumin gradients at one gravity and identified according to their sedimentation velocities (3.5, 2.8, 1.5, 1.0, and 0.6 Sv) in units of millimeters per hour. DNA determinations showed that (a) the 0.6, 1.0, and 1.5 Sv cells have a haploid DNA content and hence must be spermatids at varying stages of spermiogenesis; (b) the 2.8 and 3.5 Sv cells have a diploid DNA content and must be A, B, or primary spermatocytes. Both the 2.8 and 3.5 Sv cells synthesize DNA 2-1/2 times faster than the 2.8 Sv cells. There is very little DNA synthesis in the spermatids. In vivo incorporation of [^{14}C]arginine followed by cell separation and extraction of acid-soluble nuclear proteins for gel electrophoresis and autoradiography indicated that histones are present exclusively in the 2.8 and 3.5 Sv cells, while both histones and protamine are present in the 1.5 and 1.0 Sv cells. During the transition from 1.5 to 1.0 Sv cells, most of the histones are lost. In the mature sperm (0.6 Sv) only protamine is found. Most of the histones are synthesized in the 2.8 and 3.5 Sv cells while the protamines are synthesized in the 1.5 and 1.0 Sv cells. During or shortly after synthesis, the protemaines are extensively phosphorylated and much later, dephosphorylated. The dephosphorylation of protamine may be important in the condensation of spermatid chromatin. (Authors summ.)

15749. Perriard, Jean-Claude, Adolf Scholl, and Hans M. Eppenberger (Zool. Inst. der Univ., Sahlistrasse 8, 3000 Bern, Switzerland). 1972. COMPARATIVE STUDIES ON CREATINE KINASE ISOZYMES FROM SKELETAL-MUSCLE AND STOMACH OF TROUT. J. Exp. Zool., 182(1): 119-126.

Tissue-specific heterogeneity of creatine kinase (CPK) isozymes is particularly pronounced in various trout species. Several of the isozymes expressed in stomach and in skeletal muscle appeared to be identical as judged by their electrophoretic behavior, but reversible dissociation studies on single, electrophoretically pure, CPK-isozymes isolated from these two tissues revealed significant differences between isozymes of similar electrophoretic mobility. Moreover, in contrast to trout skeletal muscle, the native and reassociated stomach CPK isozyme patterns could be accounted for by the association of the polypeptide products of two gene loci into homodimers and heterodimers, providing further evidence that the isozymes of stomach and skeletal muscle are non-identical and thus presumably the products of distinct genes. (Authors)

15750. Sylvester, J. R. (Univ. of Wash., Coll. of Fisheries, Seattle, Washington). 1972. POSSIBLE EFFECTS OF THERMAL EFFLUENTS ON FISH: A REVIEW. Environ. Pollut., 3(3): 205-215.

Thermal stress is known to have general and specific effects on the physiology of fish. In general, over a species-specific temperature range, increasing temperatures increase metabolic rates and other activity. Deviations from optimum temperature could cause a cessation of spawning behaviour or an increase of abnormal fry. The final level of temperature acclimation is a function of species, size, condition, and past environment. Most fish can acclimate faster to higher temperatures than to lower temperatures. Fluctuating temperatures increase thermal resistance in some species. Temperature preferences in fish are a function of acclimation temperature and of the species-specific optimum temperature. Slight increases in temperature can be lethal because of synergism. (Auth.)

15751. U. S. Office of Water Resources Research (Water Resources Scientific Information Center, Washington, D. C.). 1972. LAKE ERIE - A BIBLIOGRAPHY. Available from NTIS, Springfield, Va. as PB-210 919 $3.00 in paper copy, $0.95 in microfiche. Water Resources Sci. Information Center Report WRSIC 72-209, 240 p., 221 ref.; Selected Water Resources Abstracts, 5(19): p. 13.

This bibliography, containing 221 abstracts is one in a series of planned bibliographies in water resources produced wholly from the information base comprising Selected Water Resources Abstracts (SWRA). At the time of search for this bibliography, the data base had 41,521 abstracts covering SWRA through May 15, 1972 (Volume 5, Number 10). Abstracts with full bibliographic details are listed in ascending Accession Number order. A descriptor index is made up of a fraction of the total descriptors and identifiers by which each paper in this bibliography has been indexed. These descriptors represent weighted terms that best describe the information content and are indicated by asterisks. Through permutation, each word in a multiple-word descriptor or identifier is made to file in its normal alphabetic order, thus affording a multiple access to each abstract. Another index lists the authors alphabetically and gives page numbers for the abstracts.

15752. U. S. Office of Water Resources Research (Water Resources Scientific Information Center, Washington, D. C.). 1972. LAKE ONTARIO - A BIBLIOGRAPHY. Available from NTIS, Springfield, Va. as PB-210 920, $3.00 in paper copy, $0.95 as microfiche. Water Resources Scientific Information Center Report WRSIC 72-212, 200 p., 129 ref.; Selected Water Resources Abstracts, 5(19): p. 13.

This bibliography, containing 129 abstracts is one in a series of planned bibliographies in water resources produced wholly from the information base comprising Selected Water Resources Abstracts (SWRA). At the time of search for this bibliography, the data base had 41,521 abstracts covering SWRA through May 15, 1972 (Volume 5, Number 10). A descriptor index is made up of a fraction of the total descriptors and identifiers by which each paper in this bibliography has been indexed. These descriptors represent weighted terms that best describe the information content and are indicated by asterisks. A comprehensive index represents all of the descriptors and identifiers by which each paper in this bibliography has been iddexed. Through permutation, each word in a multiple-word descriptor or identifier is made to file in its normal alphabetic order, thus affording a multiple access to each abstract. Another index lists the authors alphabetically and gives the page numbers for abstracts. Abstracts with full bibliographic details are listed in ascending Accession Number order.

15753. Turner, P. R., and R. C. Summerfelt (Okla. State Univ., Coop. Fish. Unit, Stillwater, Oklahoma). 1971. CONDITION FACTORS AND LENGTH-WEIGHT RELATIONSHIPS OF THE FLATHEAD CATFISH, Pylodictis olivaris (Rafinesque), IN LAKE CARL BLACKWELL. Proc. Okla. Acad. Sci., 51: 36-40; Selected Water Resources Abstracts, 5(19): p. 14, 1972.

Condition factors are presented for 432 flathead catfish and length-weight relationships for 224 flathead catfish collected in Lake Carl Blackwell in 16 mo., from June 1967 through Sept. 1968. The condition factor (KTL) for flathead catfish varied with total body length. A curvilinear relationship of average K factor and total length gave a better fit than did a linear relationship for fish 20 mm through 519 mm. For fish 518 mm through 879 mm total length, a linear relationship gave a better fit. Females had a larger KTL factor than males, but the KTL varied with season. The greatest KTL values occurred in prespawning females. The average KTL for the 124 female and 90 male fish used for computation of length-weight relationships were 1.30 and 1.25, respectively. The length-weight relationship (logarithmic form) was (Log 10 W = a + b Log 10 L): Log W = 5.423 + 3.189 Log L. -- Copyright 1972, Biological Abstracts, Inc.

15754. Roberts, P. E., D. Baker, and E. B. Slack. 1972. TUNA IN NEW ZEALAND WATERS. N. Z. Ministry of Agric. and Fish., Fisheries Research Division, Occasional Publication No. 4, 31 p., illus.

15755. Jearld, A., Jr., and B. E. Brown (Okla. State Univ., Coop. Fish. Unit, Stillwater, Oklahoma). 1971. FECUNDITY, AGE AND GROWTH, AND CONDITION OF CHANNEL CATFISH IN AN OKLAHOMA RESERVOIR. Proc. Okla. Acad. Sci., 51: 15-22, illus., map; Selected Water Resources Abstracts, 5(19): p. 14, 1972.

From Oct. 1967 through Aug. 1968, channel catfish were collected, chiefly by gill nets, from 6 major sites in Lake Carl Blackwell, a 3000 acre, turbid, old (dam completed in 1937) reservoir. Life history information, which can aid in the management of the sport fishery in this and similar bodies of water, was obtained. Data on fecundity, age and growth, length-weight relationships and condition factors are presented. Size at age and condition factors are among the lowest reported in the literature. The evidence indicated a late May into early June spawning period. -- Copyright 1972, Biological Abstracts, Inc.

15756. Kamps, L. R., and B. McMahon (Div. of Chem. Technology, Food and Drug Administration, Washington, D. C.). 1972. UTILIZATION OF THE WESTOO PROCEDURE FOR THE DETERMINATION OF METHYL MERCURY IN FISH BY GAS-LIQUID CHROMATOGRAPHY. Journal of the Assoc. of Official Analytical Chemists, 55(3): 590-595; Selected Water Resources Abstracts, 5(19): p. 39.

The analytical procedure developed by Westoo for the GLC determination of methyl mercury in fish utilizes HCl to provide cleanup and to partition the benzene solution in order to extract the methyl mercury chloride. After the cysteine layer is separated and acidified, the methyl mercury chloride is re-extracted into benzene. Gas-liquid chromatography is then used for final analysis of the benzene solution. This step requires calculation of the g sample/ml available since aliquots are used in the various steps and a further calculation is used to compensate for incomplete partitioning. The normal detection limit of the method is 0.08 ppm methyl mercury chloride with provisions for detecting as little as 0.02 ppm.

15757. Uthe, J. F., J. Solomon, and B. Grift (Fish. Res. Bd. of Canada, Winnipeg, Manitoba, Canada). 1972. RAPID SEMIMICRO METHOD FOR THE DETERMINATION OF METHYL MERCURY IN FISH TISSUE. Journal of the Assoc. of Official Analytical Chemists, 55(3): 583-589; Selected Water Resources Abstracts, 5(19): p. 39.

A procedure for determining methyl mercury in fish tissue involves extracting the methyl mercury into toluene as methyl mercuric bromide, partitioning the bromide into aqueous ethanol as a thiosulfate complex, and re-extracting into benzene as methyl mercuric iodide. Gas chromatography is then used to quantitate methyl mercury with a sensitivity of 0.01 ppm. Thin-layer chromatography and gas chromatography of the thin-layer spot were used to detect methyl mercury in the final extract. Comparisons were made of methyl and total mercury in tissues of various aquatic animals; the high levels of nonmethyl mercury in seals suggest that demethylase is present. None of the mercurial compounds tested interfered with the analysis. However, some samples required additional changes by column chromatography on Florisil: 3 M potassium iodide was injected intermittently to keep the column operational. Use of the concentric tube electron capture detector was recommended because of column bleed and resulting detector contamination.

15758. Grimes, C. B., and J. A. Mountain (Fla. Dept. of Natural Resources, St. Petersburg, Florida). 1971. EFFECTS OF THERMAL EFFLUENT UPON MARINE FISHES NEAR THE CRYSTAL RIVER STEAM ELECTRIC STATION. Professional Papers Series, No. 17, 64 p, 14 fig, 8 tab, 43 ref, 6 append.; Selected Water Resources Abstracts 5(19): p. 50, 1972.

A field investigation begun in 1969 to determine ecological effects of hot water discharge of a steam electric generating plant in Crystal River, Florida was continued. In 1970, a second generating unit was discharging heated water. Effects of the effluent upon the Gulf of Mexico fishes in the vicinity of the plant were studied. Bi-monthly trawl samples indicated that influence of the thermal plume had extended into previously unaffected intermediate depth areas. Species abundance at intermediate trawl stations was higher in 1970 than in 1969, except

during August. It was higher at nonaffected than affected station except in December. A species diversity determination indicated higher shallow station diversity in winter at affected stations, but higher in summer at unaffected stations. Suppressed summer diversity may be due to thermal stress on the community. Greatest diversity both winter and summer occurred at affected intermediate depth stations. A pattern of increasing diversity from north to south in trawl stations transects (shallow and intermediate depth) was also observed. The pattern was apparently related to salinity, which also increased from north to south, and/or to habitat destruction from dredging operations, which was greatest at northern stations. Frequency of occurrence of the four most abundant species (Orthopristis chrysoptera, Bairdiella chrysura, Leiostomus xanthurus, and Lagodon rhomboides) in affected vs. unaffected areas was statistically analyzed and did not differ significantly. Spawning, movement, age, and growth of these species from affected and unaffected stations were also considered.

15759. Allen, K. Radway, Richard L. Saunders, and Paul F. Elson (Fish. Res. Bd. of Canada, Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. MARINE GROWTH OF ATLANTIC SALMON (Salmo salar) IN THE NORTHWEST ATLANTIC. J. Fish. Res. Bd. Canada, 29(10): 1373-1380.

The fishery for Atlantic salmon in the west Greenland area has provided useful data for the study of marine growth of salmon. Length data from seaward migrating smolts, post-smolts, and 1-, 2-, and 3-sea-winter feeders taken at sea and 1-, 2-, and 3-sea-winter spawners taken by commercial fisheries, angling, and research traps, have been used to construct a tentative growth curve. Fish which spawned after 1 sea-winter (grilse) were smaller at the time of spawning than fish of the same smolt-class which had not matured but were still actively feeding at sea. Similarly, 2-sea-winter spawners were smaller than salmon which would not have returned until after a third sea winter. The growth rate of salmon during the summer prior to spawning was lower than that of fish which would have spawned a year or more later and appears to be about the same as that during the preceding winter. (Authors)

15760. Sandeman, I. M., and M. D. B. Burt (Dept. of Biol., Trent Univ., Peterborough, Ontario, Canada). 1972. BIOLOGY OF Bothrimonus (= Diplocotyle) (PSEUDOPHYLLIDEA: CESTODA): ECOLOGY, LIFE CYCLE, AND EVOLUTION; A REVIEW AND SYNTHESIS. J. Fish. Res. Bd. Canada, 29(10): 1381-1395.

An integrated account of the ecology and life cycle of Bothrimonus is synthesized from the literature, experiment, and observation of larval and adult stages of the parasite. Bothrimonus has a circumpolar distribution in boreal or subarctic conditions. As an adult it is found in a wide variety of fish hosts which feed in littoral or estuarine waters. Adult worms have a short life-span in the fish host and occur only seasonally. A single intermediate host appears to be involved in the life cycle and this is most commonly a brackish-water gammarid. The operculate eggs, which contain unciliated larvae, possess characteristic polar filaments which have an adhesive function. Entry is almost certainly by ingestion of eggs by the gammarid host; the larval forms often attain sexual maturity within the gammarid host with accompanying production of apparently normal eggs. Although it has been possible to infect fish hosts experimentally with larval stages, it has not yet been possible to infect gammarids with eggs obtained either from neotenic individuals in gammarids or from adults in the fish host. The life cycle of Bothrimonus indicates closer affinities of the Cyathocephalidae with caryophyllaeid than with other pseudophyllidean tapeworms. Distribution is discussed in terms of its evolution and a freshwater origin in the Ponto-Aralo-Caspian province is proposed. (Authors)

15761. FAO of the United Nations (Rome, Italy). 1972. FINAL REPORT OF THE WORKING PARTY ON TUNA AND BILLFISH TAGGING IN THE ATLANTIC AND ADJACENT SEAS. SUPPLEMENT 1 TO THE REPORT OF THE FOURTH SESSION OF THE FAO PANEL OF EXPERTS FOR THE FACILITATION OF TUNA RESEARCH. FAO Fisheries Reports, No. 118, Supplement 1, 37 p.

15762. Ducharme, L. J. A. (Resource Development Branch, Fish. Service, Dept. of the Environment, Halifax, Nova Scotia, Canada). 1972. AN APPLICATION OF LOUVER DEFLECTORS FOR GUIDING ATLANTIC SALMON (Salmo salar) SMOLTS FROM POWER TURBINES. J. Fish. Res. Bd. Canada, 29(10): 1397-1404.

Louver deflectors for guiding Atlantic salmon (Salmo salar) away from destructive power turbines were installed in a canal leading to the powerhouse at East River, Sheet Harbour, Nova Scotia, in 1966. Guiding efficiency studies, using hatchery-reared smolts, showed that a minimum approach:bypass velocity ratio of 1.0:1.5 was a prerequisite to high guiding efficiency. From 1967 to 1971, average guiding efficiency was increased from 57% to 80% through modifications which increased velocity and reduced flow turbulence in the bypass. A significant correlation existed between approach velocity and guiding efficiency within the range tested after bypass hydraulics had been modified. Tests conducted with varying louver bar spacing ranging from 5.1 to 30.5 cm (2-12 inches) showed that the wider spacings did not impair guiding efficiency. Vertical distribution of smolt migrants in the power canal indicated that over 80% of the fish remained above depth 1.3 m. This was borne out by the fact that the bypass was effective when operating to a depth of only 0.91 m. An appraisal of the practicality of the louver guiding system is presented. (Auth.)

15763. Kraft, Melvin E. (Mont. Coop. Fish. Unit, Montana State Univ., Bozeman, Montana). 1972. EFFECTS OF CONTROLLED FLOW REDUCTION ON A TROUT STREAM. J. Fish. Res. Bd. Canada, 29(10): 1405-1411.

The total number of brook trout age I and older in three runs of Blacktail Creek, Mont., was reduced approximately 62% when 90% of the normal flow was diverted for about 3 months, in comparison with 20% for runs in control sections. Both number and weight of trout in pools of the test sections generally increased, whereas those in control pools decreased. Recaptures of tagged trout also indicated movements from runs to pools in the test sections, but not in the control sections. When the flow was reduced 75% or less, there were no consistent changes in number or weight of trout in the test runs and pools, whereas those in the control sections were more marked though also inconsistent. Reduced flows had no consistent effect on the number of underyearlings. The changes in most physical characteristics after 90% flow reduction were considerably less than the degree of reduction, presumably because the stream flowed in a well defined channel. Surface area and average depth were least affected (about 42% decrease) and current velocity (75%) the most. Fast-water portions (current velocity over 0.30 m/sec) comprised over 60% of the surface area at normal flows and slow water portions over 85% of the area when the flow was reduced 90%. A multiple linear regression with the physical characteristics as independent variables and the number of trout as the dependent variable accounted for over 75% of the variation in the number of age I and older trout in runs and pools. (Auth.)

15764. Reinert, Robert E. (School of Nat. Res., The Univ. of Mich., Ann Arbor, Michigan 48104). 1972. ACCUMULATION OF DIELDRIN IN AN ALGA (Scenedesmus obliquus), Daphnia magna, AND THE GUPPY (Poecilia reticulata). J. Fish. Res. Bd. Canada, 29(10): 1413-1418.

Scenedesmus obliquus, Daphnia magna, and Poecilia reticulata accumulated dieldrin directly from water; average concentration factors (concentration in organism, dry weight, divided by concentration in water) were 1282 for the alga, 13,954 for D. magna, and 49,307 (estimated) for the guppy. The amount accumulated by each species at equilibrium (after about 1.5, 3-4, and 18 days, respectively) was directly proportional to the concentration of dieldrin in the water. Daphnia magna and guppies accumulated more dieldrin from water than from food that had been exposed to similar concentrations in water. When guppies were fed equal daily rations of D. magna containing different concentrations of insecticide, the amounts of dieldrin accumulated by the fish were directly proportional to the concentration in D. magna; when two lots of guppies were fed different quantities of D. magna (10 and 20 organisms per day) containing identical concentrations of dieldrin, however, the amounts accumulated did not differ substantially. (Auth.)

15765. Trust, T. J. (Dept. of Bacteriol. and Biochem., Univ. of Victoria, Victoria, British Columbia, Canada). 1972. INADEQUACY OF AQUARIUM ANTIBACTERIAL FORMULATIONS FOR THE INHIBITION OF POTENTIAL PATHOGENS OF FRESHWATER FISH. J. Fish. Res. Bd. Canada, 29(10): 1425-1430.

The antibacterial activity of fourteen products marketed for the therapy and prophylaxis of bacterial infections of aquarium fishes was tested. When used at the dilution recommended by the manufacturers, the products failed to inhibit the growth of bacterial species known to be potential pathogens of freshwater fishes and failed to reduce significantly the bacterial numbers in water containing fish. Concentrations of the products that were bacteriostatic, bactericidal, or sporicidal were markedly higher than the recommended concentrations. Use of the products at higher concentrations in aquaria showed two of the products to be inimical to fish. (Auth.)

15766. Groot, C. (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. MIGRATION OF YEARLING SOCKEYE SALMON (Oncorhynchus nerka) AS DETERMINED BY TIME-LAPSE PHOTOGRAPHY OF SONAR OBSERVATIONS. J. Fish. Res. Bd. Canada, 29(10): 1431-1444.

The seaward migration of sockeye salmon smolts through the Babine Lake system to its outlet was examined by taking film records of the Plan-Position-Indicator display of a high-frequency sonar whereby each frame of film was exposed during one scan of the sonar unit. Frame-by-frame analysis of the films revealed information on speed, direction, and diurnal timing of migration of sockeye smolts during a 24-hr period. Migratory activity in the lake centered around dusk and dawn, a similar pattern to that near the outlet for smolts entering the river on their way to sea. Speeds of movements were 19-51 cm/sec (mean 30 cm/sec). Greatest velocities occurred at dusk and dawn. They were close to the maximum sustained swimming speeds determined under laboratory conditions for sockeye smolts of the same size and within similar temperature ranges as in the field. The most direct movements of targets were found at twilight, when migration activity was highest. In general, directional tendencies were consistent with the shortest route to the outlet. In some observations near the junction of Main Lake and Morrison and North arms, movements were observed which would lead the smolts away from the outlet. Consequences of such movements are discussed and compared with data from tagging operations. (Auth.)

15767. Dodson, Julian J., William C. Leggett, and Robert A. Jones (Dept. of Biol., McGill Univ., Montreal 110, Quebec, Canada). 1972. THE BEHAVIOR OF ADULT AMERICAN SHAD (Alosa sapidissima) DURING MIGRATION FROM SALT TO FRESH WATER AS OBSERVED BY ULTRASONIC TRACKING TECHNIQUES. J. Fish. Res. Bd. Canada, 29(10): 1445-1449.

Five of seven adult American shad (Alosa sapidissima), tracked continuously with ultrasonic transmitters in the lower estuary of the Connecticut River in 1968 during their spawning migration to fresh water, exhibited extensive meandering, ranging 24-53 hr in duration in the region of the saltwater-freshwater interface. The salinity in the Connecticut River is like a wedge; its daily position is dependent on upland discharge, and its hourly position is dependent on tidal activity. The fish were observed during all tidal conditions and at several discharge rates, and in all cases they remained near the leading edge of salt water during the meandering phase. This behavior pattern was not a result of handling nor was it a typical behavioral response to tidal cycle. It was concluded that the meandering observed in the region of the saltwater-freshwater interface was due to physiological adaptation of the fish to fresh water. Of the remaining two shad tagged, one proceeded directly upstream without meandering, and one moved downstream. (Authors)

15768. Gilbert, Carter R., and Reeve M. Bailey (Fla. State Museum, Univ. of Fla., Gainesville, Florida 32601). 1972. SYSTEMATICS AND ZOOGEOGRAPHY OF THE AMERICAN CYPRINID FISH Notropis (Opsopoeodus) emiliae. Occasional Papers of the Museum of Zoology, Univ. of Mich., Ann Arbor, Michigan, No. 664, 35 p., illus.

15769. Patalas, K. (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg 19, Manitoba, Canada). 1972. CRUSTACEAN PLANKTON AND THE EUTROPHICATION OF ST. LAWRENCE GREAT LAKES. J. Fish. Res. Bd. Canada, 29(10): 1451-1462.

Fourteen copepod and 13 cladoceran species were found in the summer plankton of lakes Superior, Huron, Erie, and Ontario. Cyclops bicuspidatus thomasi was the most abundant species in lakes Huron, Ontario, and Erie, and Diaptomus sicilis in Lake Superior. A general trend was seen from oligotrophic Lake Superior to eutrophic Lake Erie: the diminishing significance of calanoids (Diaptomus sicilis and Diaptomus ashlandi) accompanied by the increasing predominance of cyclopoids and cladocerans (Cyclops bicuspidatus thomasi, Mesocyclops edax, Daphnia retrocurva, Daphnia galeata mendotae, Bosmina longirostris, and Bosmina coregoni coregoni). The average crustacean abundance varied from 43 individuals/cm^2 in Lake Superior to 400/cm^2 in Lake Erie, and was related to both the heat and chlorophyll content of the water. Total phosphorus loadings for the five Great Lakes were calculated using Vollenweider's criteria based on phosphorus exports from soils and human population densities in the drainage basins. They amounted to 0.03 g total P/m^2·year for Lake Superior, 0.15 for Lake Huron, 0.29 for Lake Michigan, 0.86 for Lake Ontario, and 0.98 for Lake Erie. The lake-average summer chlorophyll-α concentrations as well as Secchi disc visibilities were closely related to the phosphorus leading rates. Crustacean abundance was then indirectly related to the phosphorus loading rates. Based on the correlations found, predictions were made about changes in Secchi disc visibility and chlorophyll concentration with increasing human population densities in the drainage basin. (Auth.)

15770. Burton, Dennis T., Alma H. Jones, and John Cairns, Jr. (Dept. of Biol., and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1972. ACUTE ZINC TOXICITY TO RAINBOW TROUT (Salmo gairdneri): CONFIRMATION OF THE HYPOTHESIS THAT DEATH IS RELATED TO TISSUE HYPOXIA. J. Fish. Res. Bd. Canada, 29(10): 1463-1466.

Acute heavy metal toxicity to fish has been attributed to the coagulation or precipitation of mucus on the gills and/or to cytological damage to the gills. The physiological mechanism of death by either of the above causes is related to a breakdown in gas exchange at the gills. This study of acute zinc toxicity to rainbow trout (Salmo gairdneri) supports an earlier hypothesis that modification of the gas exchange process at the gills creates hypoxia at the tissue level. Tissue hypoxia appears to be a major physiological change preceding death once the gas exchange process at the gills is no longer sufficient to supply the oxygen requirements of the fish. (Authors)

15771. Bilinski, E., and R. E. E. Jonas (Fish. Res. Bd. of Canada, Vancouver Lab., Vancouver, British Columbia, Canada). 1972. OXIDATION OF LACTATE TO CARBON DIOXIDE BY RAINBOW TROUT (Salmo gairdneri) TISSUES. J. Fish. Res. Bd. Canada, 29(10): 1467-1471.

A comparative study on the ability of various fish tissues to carry out different stages of lactate oxidation was conducted with rainbow trout (Salmo gairdneri) Rate of oxidation of Na-L-lactate-1-^{14}C (5 mM) and Na-L-lactate-3-^{14}C (5 mM) by tissue slices from white muscle, red lateral line muscle, heart, liver, kidney, and gills was determined at 15 C by measuring the formation of $^{14}CO_2$. In all tissues the liberation of $^{14}CO_2$ was considerably higher with lactate-1-^{14}C than with lactate-3-^{14}C. Liver was the most active tissue for oxidation of lactate-1-^{14}C (2805 mμmoles/g wet tissue/hr at 15 C) and gills for oxidation of lactate-3-^{14}C (556 mμmoles/g wet tissue/hr at 15 C). With both substrates activity in the white muscle was very limited, whereas other tissues had an intermediate level of activity. The results suggest that, in trout, the catabolism of lactate may take place through oxidative decarboxylation of pyruvate and that liver plays an important role in such a process. It appears also that complete oxidation of lactate may be of significance in supplying energy for the exchange reactions in gills. (Authors)

15772. Fisher, Stuart G., and Alison LaVoy (Dept. of Biol., Amherst College, Amherst, Massachusetts 01002). 1972. DIFFERENCES IN LITTORAL FAUNA DUE TO FLUCTUATING WATER LEVELS BELOW A HYDROELECTRIC DAM. J. Fish. Res. Bd. Canada, 29(10): 1472-1476.

Water level fluctuations below a hydroelectric dam on the Connecticut River produce a freshwater "intertidal" zone. Along a transect in this zone from high to low water mark benthic invertebrates increased markedly in density and taxonomic diversity. Community composition shifted from chironomid-oligochaete predominance on the most exposed sites to mollusc predominance on the least exposed sites. (Authors)

15773. Levesque, Raymond C., and Roger J. Reed (Mass. Coop. Fish. Unit., Univ. of Mass., Amherst, Massachusetts 01002). 1972. FOOD AVAILABILITY AND CONSUMPTION BY YOUNG CONNECTICUT RIVER SHAD Alosa sapidissima. J. Fish. Res. Bd. Canada, 29(10): 1495-1499.

Food habits of young American shad (Alosa sapidissima) were studied in the Connecticut River above Holyoke, Massachusetts, 1969. Diurnal feeding data revealed a peak in stomach content volume at 8:00 PM during midsummer. Larval shad fed mainly on aquatic crustaceans and tendipedid larvae and pupae. Juveniles ingested the most abundant organisms: crustaceans, tendipedid larvae and pupae, hydropsychid larvae and adult insects. Electivity data indicated positive selection for tendipedid pupae and crustaceans and negative selection for hydropsychid larvae and tendipedid larvae. Selection of Trichoptera larvae by young shad in significant amounts was documented for the initial time. (Authors)

15774. Wilson, R. C. H. (Resource Development Branch, Fish. Serv., Dept. of the Environ., St. John's, Newfoundland, Canada). 1972. PREDICTION OF COPPER TOXICITY IN RECEIVING WATERS. J. Fish. Res. Bd. Canada, 29(10): 1500-1502.

The 96-hr LC50 of copper to Atlantic salmon parr in water taken from the Exploits River, Newfoundland, is about 125 μg/liter at a total hardness of 8-10 mg/liter $CaCO_3$ and a total alkalinity of 4 mg/liter. However, the addition of spent sulphite liquor from a pulp mill allowed fish to survive more than 180 μg/liter Cu. Considering the variety of organic compounds which have now been shown to chelate dissolved copper, it is likely that a simple model for the prediction of copper toxicity in waters receiving mine effluent will prove impossible. (Auth.)

15775. Trussell, R. P. (Fish and Wildl. Branch, Dept. of Recreation and Conservation, Victoria, British Columbia, Canada). 1972. THE PERCENT UNIONIZED AMMONIA IN AQUEOUS AMMONIA SOLUTIONS AT DIFFERENT pH LEVELS AND TEMPERATURES. J. Fish. Res. Bd. Canada, 29(10): 1505-1507.

Previous studies have shown that the un-ionized ammonia molecule and not the ammonium ion is the form of the toxicant harmful to fish. Prior attempts to quantify the amount of un-ionized ammonia in an aqueous solution have been confusing. Data given here provide ready access to the amount of un-ionized ammonia over a range of temperature and pH that is common in temperate freshwater environments. (Auth.)

15776. Cherfas, B. I., editor (Academy of Sci. of the USSR, Ministry of Fish. of the USSR). 1969. GENETICS, SELECTION, AND HYBRIDIZATION OF FISH. Ichthyological Comm. Ministry of Fish. of the RSFSR, Govt. Sci. Res. Inst. of Lake and River Fisheries; Translated from the Russian and published for NMFS and the Nat. Sci. Foundation, Washington, D. C. by the Israel Program for Sci. Translations, 266 pp. 1972. Available from the U. S. Dept. of Commerce, NTIS, Springfield, Va. 22151, IPST Cat. No. 600424; Commercial Fisheries Abstracts, NOAA CFABA 25(10): p. 16, 1972.

This publication is a collection of some papers delivered at the first All-Union Conference on Genetics, Selection, and Hybridization of Fish held in Leningrad, in 1967. Most of the papers delivered were related to carp with a few exceptions.

The subject of one of these exceptions is on the Pacific salmon (p. 131), and the subject of another is the variability and past history of rainbow trout (p. 221). The sturgeon and its hybrids are the subject of several papers. The major subtopics in the collection are as follows: Genetics, heredity, and variability of fish cytology; Hybridization of fish; and Selection of fish.

15777. Khamidov, D. Kh., B. S. Gil'dieva, L. M. Zaremskaya, A. T. Akilov, A. A. Turdyev, and K. N. Nishanbaev (Tashk. Gos. Med. Inst., Tashkent, USSR). 1972. SEASONAL CHANGES IN THE COMPOSITION OF THE BLOOD OF SOME SPECIES OF FISH. Chemical Abstracts, 76(11): 65911j; Commercial Fisheries Abstracts, NOAA CFABA, 25(10): p. 22, 1972.

15778. Smith, Gerald R., and Richard K. Koehn (Museum of Zool., Univ. of Mich., Ann Arbor, Michigan 48104). 1971. PHENETIC AND CLADISTIC STUDIES OF BIOCHEMICAL AND MORPHOLOGICAL CHARACTERISTICS OF Catostomus. Reprint from Systematic Zoology, 20(3): 282-297.

Sixteen of the nominal species in the genus Catostomus, predominantly in western North America, form a progressive morphological sequence in which adjacent forms are similar and perhaps not reproductively isolated. Several cladistic estimates indicate divergence in two primary lines or directions. The oldest cladistic furcation is phenetically trivial. Significant phenetic trends indicate evolution at several levels. The dominant trend involves osteological, oral, and hemoglobin characteristics leading to the mountain suckers, Secondary phenetic trends in body shape and in size of fins and scales have led to adaptations for life in large rivers in three separate lines. Two phenetic trends, involving meristic and serum protein characters, are involved in the adaptation of populations to local climatic conditions. (Authors)

15779. Dickson, Kenneth L., and John Cairns, Jr. (Biol. Dept. and Center for Environ. Studies, Va. Polytechnic Inst. and State Univ., Blacksburg, Virginia 24061). 1972. THE RELATIONSHIP OF FRESH-WATER MACROINVERTEBRATE COMMUNITIES COLLECTED BY FLOATING ARTIFICIAL SUBSTRATES TO THE MacARTHUR-WILSON EQUILIBRIUM MODEL. Amer. Mid. Nat., 88(1): 68-75.

The invasion by macroinvertebrates of floating-type substrate samplers utilizing 3M Corporation's No. 200 conservation web appears to fit the simple exponential models for colonization and extinction rate which are part of the equilibrium model for island fauna, proposed by MacArthur and Wilson. Stability in the number of taxa, number of specimens and community structure [$(\overline{d} = -\sum_{i}^{1} N_i/N) \log_2 (N_i/N)$] through time did not occur, indicating that the artificial substrate material did not offer sufficiently diverse habitats for community interactions to produce a relatively stable community structure. High variability existed in the number of taxa, number of specimens and community structure analyses ($\overline{d}$) between replicate samplers at each sampling period, indicating that artificial substrates utilizing the 3M Corporation's No. 200 conservation web are not very reliable in collecting quantitative data. However, these samplers do selectively sample important fish food organisms such as mayflies, stoneflies, hellgrammites and caddisflies. (Authors)

15780. Moon, Thomas W., and P. W. Hochachka (Dept. of Zool., Univ. of British Columbia, Vancouver 8, British Columbia, Canada). 1972. TEMPERATURE AND THE KINETIC ANALYSIS OF TROUT ISOCITRATE DEHYDROGENASES. Comp. Biochem. Physiol., 42(4B): 725-730.

Enzyme heterogeneity at the liver IDH locus(i) has been examined in a hatchery population of rainbow trout as related to the observed K_m-temperature response. Those genotypes which show multiple IDH forms exhibit an increase in K_m at high assay temperatures, resulting in thermal stabilization of reaction at low (intracellular) substrate concentrations. A large number of individuals, however, maintain a single IDH in liver and the possibility of modulation by cellular metabolite, ion and/or enzyme concentration alterations is discussed as methods for this phenotype to achieve thermally compensated activities. (Authors)

15781. Wasserman, Lina, Artur Ber, and David Allalouf (Endocrinol. Dept. of the Rogoff-Wellcome Med. Res. Inst., Beilinson Hospital, Petah-Tikva, Israel). 1972. ACIDIC GLYCOSAMINOGLYCAN COMPOSITION OF THE GILLS OF Cyprinus carpio. Comp. Biochem. Physiol., 43(4B): 669-677.

Crude preparation of acidic glycosaminoglycans was isolated from the soft tissue of the gills of carps (Cyprinus carpio) and fractionated by precipitation with cetylpyridinium chloride in the presence of various concentrations of NaCl. The major part of glycosaminoglycans found in the gills appears to be a mixture of chondroitin sulfates at various levels of sulfation and of glucosamine-containing substances which likely belong to the heparan sulfate or heparin groups. Anti-coagulant activity was found in most fractions particularly in the glycoproteinic one. The presence of anticoagulant glycosaminoglycans in connective tissues was discussed in relation to the biology of gills in the fish. (Authors)

15782. Congleton, James L. (Dept. of Marine Biol., Scripps Inst. of Oceanogr., La Jolla, California). 1972. BLOOD LACTATE CONCENTRATIONS IN PINK SALMON (Oncorhynchus gorbuscha) BEFORE AND AFTER SPAWNING. Comp. Biochem. Physiol., 43(4B): 717-720.

Unspawned pink salmon were captured on their fresh-water spawning grounds. Serial blood samples were withdrawn via an indwelling aortic catheter and analyzed for lactate ion. Following postoperative recovery a progressive increase in circulating lactate was observed which continued for up to 10 days. In several cases blood lactate levels in excess of 7 m-equiv/l. were attained before death. It is suggested that the observed increase in circulating lactate ion is ancillary to the general physiological deterioration of sexually mature pink salmon. (Auth.)

15783. Holmberg, Bo, Sören Jensen, Åke Larsson, Kerstin Lewander, and Mats Olsson (Dept. of Zoophysiol., Univ. of Göteborg, Fack, S-400 33 Göteborg 33, Sweden). 1972. METABOLIC EFFECTS OF TECHNICAL PENTACHLOROPHENOL (PCP) ON THE EEL Anguilla anguilla L. Comp. Biochem. Physiol., 43(1B): 171-183.

Eels (Anguilla anguilla L.) were exposed to sea water and fresh water containing 0.1 ppm pentachlorophenol (PCP). The accumulation of the pesticide as well as the effects on different metabolites in blood, muscle and liver were studied. PCP exposure caused changes, which indicated a hypermetabolic state with accelerated utilization of tissue energy reserves. An altered cholesterol metabolism, a decreased activity of liver glutamate pyruvate transaminase (GPT) and an enlargement of the liver suggested a disturbed liver function. The effects of PCP seemed to persist in spite of a recovery period in clean water for about 2 months. (Authors)

15784. Bannister, J. V. (Dept. of Physiol. and Biochem., Royal Univ. of Malta, Msida, Malta). 1972. MULTIPLE FORMS OF HAEMOGLOBIN IN THE DOLPHIN Coryphaena hippurus (L.). Comp. Biochem. Physiol., 43(1B): 29-31.

Cellulose acetate membrane electrophoresis and isoelectric focussing revealed a multiple haemoglobin phenotype in the dolphin Coryphaena hippurus. The electropherograms showed nine haemoglobin components which migrated cathodically in three groups. Isoelectric focussing showed up to thirteen haemoglobin components with apparent isoelectric points between pH 5 and pH 9. (Auth.)

15785. Nicol, J. A. C., and H. J. Arnott (The Univ. of Texas, Marine Sci. Inst. at Port Aransas, Texas). 1972. RIBOFLAVIN IN THE EYES OF GARS (LEPISOSTEIDAE). Can. J. Zool., 59(9): 1211-1214.

Eyes of gars (Lepisosteidae) have a yellow tapetum lucidum containing an as yet uncharacterized yellow pigment. They also contain fairly high levels of riboflavin, about 14 mg/100 g wet weight, which lies in tissues external to the retina and tapetum and which is, therefore, not a tapetal pigment. (Authors)

15786. Gradwell, Norman (Dept. of Biol., McGill Univ., Montreal, Quebec, Canada). 1972. HYDROSTATIC PRESSURES AND MOVEMENTS OF THE LAMPREY, Petromyzon, DURING SUCTION, OLFACTION, AND GILL VENTILATION. Can. J. Zool., 50(9): 1215-1223.

Sucker pressures are negative relative to ambient pressure, except for the sucker's anterior periphery, where positive pressures prevail. Pressures associated with small rhythmic as well as large sporadic branchial movements are transmitted to the sucker and naris. However, sucker pressures (as great as -90 to 110 cm H_2O) associated with tongue movements are not transmitted to the naris or gill pouches. Manual abduction of the sucker caused suction to exceed -120 cm H_2O before disengagement. The complex sucker pressure waveform suggests that it is generated by branchial movements combined with some other factors, as yet unknown. During quiet breathing there is no apparent intermixing of water between different gill pouches via their internal confluence with the water tube. (Auth.)

15787. Chamberlain, Lawrence L. 1972. PRIMARY PRODUCTIVITY IN A NEW AND AN OLDER CALIFORNIA RESERVOIR. Calif. Fish and Game 58(4): 254-267.

The sport fishery in new reservoirs often reaches a peak and then undergoes a marked decline a few years following impoundment. One theory attributes such declines to diminishing basic fertility. To test this theory, primary production in a new reservoir was measured by the C^{14} method for 4 years. An older reservoir served as a control. High initial rates of carbon fixation in the new reservoir, attributed to flooding of organic material, were transitory. Subsequent patterns of primary productivity were similar in the two waters. Increases in primary productivity in both reservoirs were associated with establishment of planktivorous fish populations and demonstrated that declining primary productivity is not an inevitable result of initial reservoir aging.

15788. Von Geldern, C. E., Jr. 1972. A MIDWATER TRAWL FOR THREADFIN SHAD, Dorosoma petenense. Calif. Fish and Game, 58(4): 268-276.

A midwater trawl designed to monitor threadfin shad abundance in restricted environments was developed at Lake Nacimiento, California, in 1966 and 1967. The trawl features hydrofoils and depressors which plane at 45° angles. It dives rapidly without supplementary weights or diving doors along the bridles or towing warps.

15789. Martin, Michael. 1972. MORPHOLOGY AND VARIATION OF THE MODOC SUCKER, Catostomus microps Rutter, WITH NOTES ON FEEDING ADAPTATIONS. Calif. Fish and Game, 58(4): 277-284.

Occurrence of the Modoc sucker, Catostomus microps Rutter, one of the most localized species in the freshwater fish fauna of California, is reported from the type locality at Rush Creek, Modoc County. A diagnosis of the species with data from ten recently collected topotypes and a summary of the morphometric and meristic variation of this species is reported. Catostomus microps shows distinct adaptation to swift-stream conditions in the osteological features of the oromandibular region and in the closure of the fontanelle of the neurocranium. It differs from all other members of the Pantosteus subgenus by the absence of lateral notches in the lips and by the possession of a silvery peritoneum. Ecological information is included in the discussion of this rare species.

15790. Mais, Kenneth F. 1972. A SUBPOPULATION STUDY OF THE PACIFIC SARDINE. Calif. Fish and Game, 58(4): 296-314.

A subpopulation study was made of Pacific sardines inhabiting the west coast of North America and Mexico. A method of statistical treatment was utilized to determine the amount of overlap of single and combined meristic and morphometric characters. Results indicate the existence of three stocks centered in California, Baja California (Mexico), and the Gulf of California (Mexico). California and Baja California fish were very similar, but Gulf of California sardines appear to be a more distinctive and separate stock.

15791. Jones, Albert C. 1972. CONTRIBUTIONS TO THE LIFE HISTORY OF THE PIUTE SCULPIN IN SAGEHEN CREEK, CALIFORNIA. Calif. Fish and Game, 58(4): 285-290.

The Piute sculpin, Cottus beldingi Eigenmann and Eigenmann, is the dominant fish by number and weight in Sagehen Creek, a mountain stream on the east slope of the Sierra Nevada. Sculpins are at their greatest density in the middle part of the creek where they, along with brook trout (Salvelinus fontinalis) and rainbow trout (Salmo gairdneri), find good foraging for bottom dwelling aquatic insect larvae. The numbers of sculpins are low in the precipitour headwaters of Sagehen Creek and also low in the lower reaches of the stream, which are frequented by their chief predator, the brown trout (Salmo trutta), and by other fishes. Sculpins in Sagehen Creek and Lake Tahoe exhibit minor differences in growth and reproduction but appear to occupy a similar ecological niche in the two areas.

15792. Bury, R. Bruce. 1972. THE EFFECTS OF DIESEL FUEL ON A STREAM FAUNA. Calif. Fish and Game, 58(4): 291-295.

The spillage of approximately 2,000 gallons of diesel fuel into Hayfork Creek, California, resulted in a large kill of invertebrates, fishes, and other life. Subsequent effects on the stream fauna are discussed. This study examines the increasing threat of pollution in remote areas due to the transportation of petrochemicals.

15793. Moring, John R. 1972. CHECK LIST OF INTERTIDAL FISHES OF TRINIDAD BAY, CALIFORNIA, AND ADJACENT AREAS. Calif. Fish and Game, 58(4): 315-320.

Intertidal fishes of Trinidad Bay, California, were sampled from May 1965 to May 1970. The 1,517 fishes collected represented 20 species. Three additional species were collected intertidally near Point St. George, Del Norte County. As no check lists of tidepool fishes of Humboldt and Del Norte counties are currently available, a check list is provided for Trinidad Bay species, with supplemental notes for adjacent regions.

15794. Iverson, Ernest W. 1972. NEW HOSTS AND BATHYMETRIC RANGE EXTENSION FOR Colobomatus embiotocae (CRUSTACEA, COPEPODA). Calif. Fish and Game, 58(4): 323-325.

The parasitic copepod is reported on pink seaperch Zalembius rosaceus and on spotfin surfperch, Hyperprosopon anale. The bathymetric range of C. embiotocae was extended to 40 fathoms.

15795. Kukowski, Gary E. 1972. SOUTHERN RANGE EXTENSION FOR THE YELLOWFIN GOBY, Acanthogobius flavimanus (Temminck and Schlegel). Calif. Fish and Game, 58(4): 326-327.

Four specimens of the yellowfin goby were collected from Elkhorn Slough, Monterey County, California. The origin of these specimens may be a result of natural dispersion from San Francisco Bay.

15796. Simmons, George M., Jr., and Avis Winfield (Dept. of Biol. Va. Commonwealth Univ., Richmond, Virginia 23220). 1971. A FEASIBILITY STUDY USING CONSERVATION WEBBING AS AN ARTIFICIAL SUBSTRATE IN MACROBENTHIC STUDIES. Virginia Journal of Science, 22(2): 52-59.

A feasibility study was undertaken on a small woodland stream to test a new artificial substrate, Conservation Webbing. The purpose of the study was to evaluate how well the community collected on the substrate material mirrored the natural stream community. Four orders of aquatic insects were consistently found on the substrate material. Two of these orders, the Plecoptera and Diptera, showed a statistically significant increase in numbers with increasing time. The increase in Plecoptera was due to the development of two winter stonefly species, Allocapnia rickeri and Allocapnia virginiana. Certain species of aquatic insects were collected only from the artificial substrate. Conservation Webbing collected 63% of the fauna known to occur in the stream. It appears that the material would be suited for life history studies of certain species of aquatic insects. (Authors)

15797. Koch, H. J. A., and J. Backx (Zool. Inst. of the University, Leuven (Louvain), Belgium). 1969. A MINIATURE ELECTROFOCUSING METHOD. Reprint from Science Tools, Vol. 16, pp. 44-47.

An electrofocusing method using miniature columns is described. The quantity of Ampholine carrier ampholytes required is only one fifteenth of that needed for filling an analytical LKB electrofocusing column. Even very minute quantities of protein can be analyzed. The resolution is comparable to that in the large columns. When electrofocusing is completed, the miniature columns are transferred at once to a deep-freeze. The pI are estimated with a precision of 0.1 pH unit or better, by determining the pH in small cylindrical segments resulting from sectioning the deep-frozen column. The method has proved suitable for colored proteins, such as hemoglobins, and can probably be adapted also for noncolored proteins. (Authors summ.)

15798. Flagg, Lewis N. 1972. THE ANADROMOUS SMELT FISHERY OF MAINE. Maine Sea & Shore Fisheries Research Bull. No. 33. Reprint from National Fisherman, 6 p.

The most critical period known for the smelt is while on the spawning grounds during the egg deposition and incubation period. Heavy fishing pressure on spawning grounds, if not properly controlled, can be detrimental to smelt stocks. The present large number of special regulations cause much confusion to the general public and are cumbersome and difficult to enforce. In many cases, special legislation overlaps the General Law, which basically accomplishes the same purposes. A single, well-defined law based on coastwide management of the species, but tailored to fit local problems, would alleviate the present overlapping and inconsistent legislation. This single law should include the following points: (a) A creel limit during the spring run. (b) Restricting method of capture to allow for taking of smelts without treading on spawning grounds. (c) Restricting taking of smelts to the tidal portion of streams and brooks in the areas which have limited spawning areas available. (d) Empowering the commissioner of Sea & Shore Fisheries to impose more restrictive regulations in areas where smelt runs are critically low. Such restrictive regulations may include, but not be limited to, the establishment of spawning sanctuaries, limiting the catch, restricting the numbers of fishermen per day and/or the restriction of the season for taking of smelts.

15799. Christensen, G. M., J. M. McKim, W. A. Brungs, and E. P. Hunt (Environ. Protection Agency, Nat. Water Qual. Lab., Duluth, Minnesota). 1972. CHANGES IN THE BLOOD OF THE BROWN BULLHEAD [Ictalurus nebulosus (Lesueur)] FOLLOWING SHORT AND LONG TERM EXPOSURE TO COPPER (II). Toxicology and Applied Pharmacology, 23(3): 417-427.

Blood from brown bullheads exposed to Cu (II) from 3.4 to 104 μg/l for 6, 30 and 600 days was analyzed to identify and evaluate changes in red blood cells, hematocrit, hemoglobin, plasma chloride, plasma total protein, plasma glucose, plasma glutamic oxaloacetic transaminase (PGOT, W-aspartate: 2-oxoglutarate aminotransferase) and plasma lactic dehydrogenase (PLDH, L-lactate: NAD oxidoreductase). After 6 days, glucose and hematocrit increased significantly above the controls; after 30 days, chloride and protein decreased, and hematocrit, hemoglobin and glucose increased; after 600 days, the transaminase decreased. The maximum concentration of Cu (II) having no detectable effect upon the brown bullhead was determined to be between 11 and 16 μg/l. (Authors)

15800. Isaia, J. (Lab. de Physiol. Cell. et Groupe de Biol. Mar. du C.E.A. - Faculte des Sci. de l'Univ. de Nice, Nice, France). 1972. COMPARATIVE EFFECTS OF TEMPERATURE ON THE SODIUM AND WATER PERMEABILITIES OF THE GILLS OF A STENOHALINE FRESHWATER FISH (Carassius auratus) AND A STENOHALINE MARINE FISH (Serranus scriba, Serranus cabrilla). J. Exp. Biol., 57(2): 359-366.

Comparative effects of temperature on the permeability of the gill to water and to sodium were studied in the marine sea perch Serranus and the freshwater goldfish Carassius. The acclimation Q_{10} for the water fluxes is higher in the freshwater fish than in the marine fish. In the goldfish the osmotic permeability (P_{os}) is greater than the diffusional permeability (P_{dif}) at all acclimation

temperatures, suggesting the presence of 'water-filled channels' in the branchial membrane. In the sea perch, on the other hand, P_{os}/P_{dif} is approximately 1, indicating that water movements probably occur by simple diffusion. The permeabilities to water and to sodium are similar in the sea perch but very different in the goldfish. Considering these results together with those from a similar study on an elasmobranch, it would seem that the more perfect the semipermeability of the gill membrane and the weaker the transepithelial osmotic gradient, the greater is the branchial porosity. Assuming that temperature changes do not cause modification of the branchial surface or relative permeabilities to water and to sodium the independence of the temperature-coefficient variations for water and for sodium indicates a certain dissociation between the movements of salt and of water, in the sea perch. In the goldfish, assuming a constant branchial surface and in view of the fact that $P_{os} > P_{dif}$, the high temperature coefficients for the water fluxes suggest that the water in the 'water-filled channels' is in a highly organized state. (Auth. summ.)

15801. Motais, R., and J. Isaia (Lab. de Physiol. Cell. et Groupe de Biol. Mar. du C.E.A. - Faculte des Sci. de l'Univ. de Nice, Nice, France). 1972. EVIDENCE FOR AN EFFECT OF OUABAIN ON THE BRANCHIAL SODIUM-EXCRETING PUMP OF MARINE TELEOSTS: INTERACTION BETWEEN THE INHIBITOR AND EXTERNAL Na AND K. J. Exp. Biol., 57(2): 367-373.

In all marine fish, both stenohaline and euryhaline, the net sodium excretion by the gill, compensating for intestinal absorption, is the result of a Na_{int} - K_{ext} exchange. In a euryhaline fish, such as the eel, in which a sodium exchange diffusion (linkage of sodium influx and outflux) also occurs, the two kinds of exchange (Na-Na and Na-K) can be regarded as alternative modes of behaviour of the same transport system. In normal sea water both exchanges take place at the same time; in K-free sea water the system exchanges Na for Na exclusively and in Na-free solution containing K the system exchanges Na for K exclusively. The transport system is located on the external membrane since it is inhibited by ouabain added in the external medium. The Na-K process is ouabain-sensitive but K can antagonize the inhibitory action of the glycoside. The Na-Na process on the other hand is not ouabain-sensitive. (Authors summ.)

15802. Brisson-Martin, Andrée, and François Lachiver (Lab. de Physiol. gen. et comp., Museum national d'Histoire naturelle, Laboratoire d'Endocrinologie comp. associe au C.N.R.S., Paris, France). 1972. In Vitro BIOSYNTHESIS OF THYROGLOBULIN IN THE ADULT ATLANTIC SALMON (Salmo salar L.). INFLUENCE OF THE TEMPERATURE OF INCUBATION. [Biosynthese in vitro de la thyroglobuline chez le Saumon atlantique adulte (Salmo salar L.). Influence de la temperature d'incubation]. General and Comparative Endocrinology, 19(2): 201-211. In French with English abstract.

Biosynthesis of thyroglobulin in vitro, incorporating tritiated tyrosine (^{3}H-tyr), has been studied in the migratory adult Atlantic salmon (Salmo salar L.) at two stages of its life cycle, upstream migration and at spawning, and as a function of incubation temperature. By sucrose density gradient certrifugation analysis of the soluble thyroid proteins, three labeled fractions were found, similar to those in the mammalian thyroid: a heterogeneous 3-85 component, subunit and prethyroglobulin (pre TG). Biosynthesis of thyroid proteins was independent of iodination. ^{3}H-Tyr incorporation into newly synthesized pre TG, noticeable at an incubation temperature of 5°C, increased between 5° and 20°C. Under the conditions employed, the pre TG has a sedimentation coefficient of 16.7S, lower than that of native thyroglobuline (17.7S), and was nearly entirely dissociated into 10.5 S subunits by sodium dodecyl sulfate (SDS). At 30°C, which exceeds the lethal temperature of salmonids, biosynthesis of pre TG was slight. The pre TG formed at 30°C had a sedimentation coefficient of 18.6 S, and it was partially dissociated into 11.6 S subunits by SDS. A possible effect of the experimental conditions on the molecular structure of pre TG in poikilotherms is discussed. Our results indicate that thyroid activity is more intensive in the salmon at the beginning of the upstream migration than at spawning. (Authors)

15803. Donaldson, Edward M., Fumio Yamazaki, Helen M. Dye, and William W. Philleo (Fish. Res. Bd. of Canada, W. Vancouver, British Columbia, Canada). 1972. PREPARATION OF GONADOTROPIN FROM SALMON (Oncorhynchus tshawytscha) PITUITARY GLANDS. General and Comparative Endocrinology, 18(3): 469-481.

A procedure is described for the purification of pituitary gonadotropin from the salmon (Oncorhynchus tshawytscha) by means of ethanol extraction, gel filtration on Sephadex G-100 (preparation SG-G100) and ion exchange chromatography on DEAE-cellulose; (preparations SG-DEAE-1 to 7). Bioassays were carried out using either the goldfish spermiation response or the augmentation of radiophosphate uptake by chick testis. In the goldfish assay, 1 mg SG-G100 and SG-DEAE-2 were equivalent to approximately 2,150 IU HCG and 10,000 IU HCG, respectively. In the chick assay, SG-G100 had a potency of 0.10 X NIH-LH-S16. The sedimentation coefficients S_{20w} for SG-DEAE-3 and SG-G100 were determined by ultracentrifugation to be 2.57 and 2.65, respectively. Molecular weights (M) calculated using the Svedberg equation for SG-DEAE-3 and SG-G100 were 28,524 and 29,411, respectively. At pH 1.4, S_{20w} for SG-G100 was 1.38 and M = 12,805. Direct determination of M by gel filtration using nonglycoproteins as standards gave an M value for SG-G100 of 40,000. Stokes radius for SG-G100 was determined by gel filtration to be 26.5 Å and a diffusion coefficient of 8.9 X 10^{-7} cm^2 sec^{-1} was calculated. (Authors)

15804. Cannon, L. R. G. (Depts. of Parasitology and Zoology, Univ. of Toronto, Ontario, Canada). 1972. STUDIES ON THE ECOLOGY OF THE PAPILLOSE ALLOCREADIID TREMATODES OF THE YELLOW PERCH IN ALGONQUIN PARK, ONTARIO. Can. J. Zool., 50(9): 1231-1239.

Distribution and abundance of adult worms of Bunodera sacculata, Bunodera luciopercae, and Crepidostomum cooperi were examined. Bunodera species were restricted to perch, were found in fish from both deep and shallow water, but were more common in large rather than small lakes. Infection was independent of sex of perch for all three flukes. Bunodera luciopercae, and to a lesser extent B. sacculata, increased in incidence with increase in length and age of perch, but C. cooperi did not. Incidence of Bunodera species declined in summer; C. cooperi did not. It was experimentally determined that differential sensitivity of adults of all three species to increased temperature was related to seasonal changes in incidence. The microhabitat of juvenile B. luciopercae was the gallbladder, but of B. sacculata and C. cooperi it was the intestine. Adults of C. cooperi were found predominantly in the intestinal ceca, of B. sacculata anterior intestine, and of B. luciopercae posterior intestine. The coexistence of these three closely related species is discussed in terms of the temporal and spatial differences of habitat utilization. (Auth.)

15805. Louie, Andrew J., and Gordon H. Dixon (Dept. of Biochem., The Univ. of Br. Columbia, Vancouver 8, British Columbia, Canada). 1972. TROUT TESTIS CELLS. II. SYNTHESIS AND PHOSPHORYLATION OF HISTONES AND PROTAMINES IN DIFFERENT CELL TYPES. J. Biol. Chem., 247(17): 5498-5505.

Trout testis cells were labeled with [^{3}H]arginine or lysine and inorganic [^{32}P]phosphate. Cells at different stages of spermatogenesis were separated by their differing velocities of sedimentation in serum albumin gradients at one gravity. The basic proteins from each of these cell types were separated and analyzed for radioactivity in starch gels. Most of the histones were synthesized and phosphorylated in diploid cells of sedimentation velocity 2.8 and 3.5; very little synthesis or phosphorylation of histone occurred in the spermatids. Although different rates of histone synthesis and phosphorylation were found in different cell types, the ratios of synthesis to phosphorylation were close to unity in each case. The positive correlation between these and the rates of DNA synthesis suggest that the phosphorylation of histone may be required for the correct binding of histone to DNA. The half-life of phosphate in histones varied from 8 to 13 hours in cells actively synthesizing histones but was very long in protamine stage spermatids. In addition, labeled arginine did not appear in unmodified histone IV until 21 hours after the start of the incorporation suggesting that newly

synthesized histone IV may pass through a series of modifications before reaching its final unmodified state. Protamine synthesis begins in spermatid cells at a middle stage of spermiogenesis and the newly synthesized protamine is extensively phosphorylated. The cellular specificity of histone phosphorylation suggests that this process is not required for the progressive loss of histones during the transition of spermatids sedimenting at 1.5 mm per hour to spermatids sedimenting at 1.0 mm per hour. (Authors summ.)

15806. Candido, E. Peter M., and Gordon H. Dixon (Dept. of Biochem., The Univ. of Br. Columbia, Vancouver 8, British Columbia, Canada). 1972. TROUT TESTIS CELLS. III. ACETYLATION OF HISTONES IN DIFFERENT CELL TYPES FROM DEVELOPING TROUT TESTIS. J. Biol. Chem., 247(17): 5506-5510.

Acetylation of histones has been observed in both the spermatocytes and spermatids from developing trout testis. In the former cell type, both histone synthesis and extensive acetylation occur, whereas in the spermatids there is histone acetylation, but very little synthesis. The half-life of the histone acetyl groups is approximately 23 hours in the pre-spermatid cells. It is suggested that the acetylation of histones in spermatids may serve a different function from the corresponding modification observed in the earlier testis cells. (Authors summ.)

15807. Flain, M. (Fish. Lab., Marine Dept., Christchurch, New Zealand). 1972. EARLY RECOVERIES OF FIN-CLIPPED QUINNAT SALMON IN NEW ZEALAND. N. Z. Journal of Marine and Freshwater Research, 5(3 & 4): 516-518.

Early Marine Department records (1930-42) show that of about 100,000 parr, of quinnat salmon Oncorhynchus tshawytscha (Walbaum), fin clipped at the Marine Department's Hakataramea Salmon Hatchery in south Canterbury, only 3 were positively recovered; later independent readings of scales from these fish agreed with the known age. A further 11 scale samples (for 1937 and 1939) of fin clipped fish have been read, but details of their recovery and of their fin-clip combinations cannot be found. Thus, from approximately 100,000 fin clipped parr, only 14 recoveries can be substantiated. (Auth.)

15808. Evans, Ronald J., Jack D. Bails, and Frank M. D'Itri (Fish Div., Mich. Dept. of Nat. Resources, Lansing, Michigan 48926). 1972. MERCURY LEVELS IN MUSCLE TISSUES OF PRESERVED MUSEUM FISH. Environmental Science & Technology, 6(10): 901-905.

Flameless atomic absorption spectrophotometry was used to establish the total mercury levels in 57 preserved fish specimens of various species collected in the Lake St. Clair-Western Lake Erie region of the Great Lakes between the years of 1920-65. Only five fish were found to contain mercury levels in excess of 0.5 ppm - three large muskellunge collected in Lake St. Clair in 1939 (2.38, 1.57, and 1.58 ppm) and two adult sea lampreys collected in the Clinton River tributary to Lake St. Clair in 1938 (0.90 and 1.29 ppm). A trend was established relating the mercury content of selected categories of fishes with the year and location of collection for the fish specimens. The 1970-71 mercury levels in fish from the two study areas were found to average more than those preserved museum specimens in the same categories taken from the same area. (Authors)

15809. Flain, M. (Fish. Lab., Marine Dept., Christchurch, New Zealand). 1971. REPEATED SPAWNING AND SURVIVAL OF MALE QUINNAT SALMON IN NEW ZEALAND. N. Z. Journal of Marine and Freshwater Research, 5(3 & 4): 519-521.

In the Marine Department archives, early records (1930-41) of marked parr of quinnat salmon Oncorhynchus tshawytscha (Walbaum) show that some held in freshwater hatchery ponds in south Canterbury survived development of testes for two consecutive years, and that one fish developed testes for three consecutive years and gave indications that it might survive into the fourth. It is generally believed that all wild adults of this species die after one spawning. (Auth.)

15810. Eisler, Ronald, and Gilles LaRoche (U. S. Environ. Protection Agency, Natl. Mar. Water Qual. Lab., West Kingston, Rhode Island). 1972. ELEMENTAL COMPOSITION OF THE ESTUARINE TELEOST Fundulus heteroclitus (L.). J. Exp. Mar. Biol. Ecol., 9(1): 29-42.

Elements that were consistently present in whole ashed Fundulus heteroclitus (L.) as determined by atomic absorption spectroscopy were Ca, Cu, Fe, K, Mg, Mn, Na, Sr, and Zn; not measurable were Ag, Al, Au, Ba, Be, Cd, Co, Cr, Cs, Li, Ni, Pb, Rb, and Tl. This pattern was not affected by the age of the fish, its sexual condition, or the season of collection. Changes in whole body content of selected elements were observed with increasing age: in the range between 46 and 118 mm total body length, large fish contained more Ca and Sr and less K, Mg, Na, and Zn than small fish; Fundulus intermediate in size exhibited intermediate values for these elements. On an ash weight basis, heads were comparatively low in K, Fe, Mg, Zn, and Sr and carcasses comparatively high in K and low in Cu, Fe, Sr, and Na. Viscera contained high concentrations of most elements when compared with heads and carcasses, especially Fe, Zn, Sr, and Cu. In a study of the effect on whole body elemental content of two size ranges of Fundulus, at two water temperatures, two salinities, and two acclimatization periods, we found that Fundulus 84 mm in length contained more Ca, and less Cu, K, Mg, Na, and Zn per unit weight than those measuring 47 mm. Within each size group, fish kept at 5 or 20°C at salinities of 9 °/oo or 27 °/oo exhibited essentially the same elemental composition after 30 days: however, fish held for 30 days when compared with those held for only three days contained significantly less Ca, Na, K, Mg, Zn, Cu, and Mn. In another study on effects of three sea-water formulations, two feeding frequencies, and two medium replacement rates on whole body elemental composition, changes were least pronounced during a 30-day period among fish that were fed daily as compared with weekly, that were held in a sea-water formulation developed by our laboratory as compared with natural sea water or a commercial preparation, and among groups with the medium replaced twice weekly compared with no replacement. Selected data on the elemental composition of other species of teleosts and elasmobranchs are presented and discussed. (Authors)

15811. Bashamohideen, M., and V. Parvatheswararao (Dept. of Zool., Sri Venkateswara Univ., Tirupati, India). 1972. ADAPTATIONS TO OSMOTIC STRESS IN THE FRESH-WATER EURYHALINE TELEOST Tilapia mossambica. IV. CHANGES IN BLOOD GLUCOSE, LIVER GLYCOGEN AND MUSCLE GLYCOGEN LEVELS. Marine Biology, 16(1): 68-74.

Some aspects of osmoregulation energetics have been studied in the euryhaline teleost Tilapia mossambica (Peters) acclimated to media of different salinities. In stress media (75 and 100 % sea water) the blood glucose of the fish increases significantly, accompanied by a corresponding increase in oxygen consumption and cytochrome-oxidase activity, suggesting that oxidative degradation of blood glucose is the predominant energy source for osmotic work in these stress media. It is likely that the variations in the blood-glucose level as a function of acclimation to the heterosmotic media - except the natural fresh-water medium - are governed by the combined effects of salinity of the medium and blood-medium osmotic gradient, rather than by the effect of any one of them separately. Perhaps, metabolic homoeostasis is in operation in the natural fresh-water medium. Depletion of muscle glycogen at significant levels is noticed only in stress media. Presumably, there is an augmentation of oxidative metabolism with glycolysis to meet the exacting energy demands for heavy osmotic work in high-stress media. Prior acclimation to 75% sea water (24.375 °/oo S) facilitates subsequent acclimation to 100% sea water (32.50 °/oo S) with less energy cost - an instance of "facilitation acclimation". Smaller individuals of T. mossambica osmoregulate with less energy expenditure than larger ones. Thus, smaller individuals are osmotically more efficient. (Authors)

15812. Cairns, John, Jr. 1972. RATIONALIZATION OF MULTIPLE USE OF RIVERS. Reprint from: River Ecology and Man, pp. 421-430.

15813. Stegeman, John J., and Erwin Goldberg (Dept. of Biol. Sci., Northwestern Univ., Evanston, Illinois). 1972. PROPERTIES OF HEPATIC HEXOSE-6-PHOSPHATE DEHYDROGENASE PURIFIED FROM BROOK TROUT AND LAKE TROUT. Comparative Biochemistry and Physiology, 43(2B): 241-256.

Brook trout hexose-6-phosphate dehydrogenase (H6PD) and lake trout H6PD are essentially identical in several parameters including pH optima, kinetic properties and activation energy. They differ in thermal stability. The various oxidations catalyzed by trout H6PD differ in their response to the presence of Mg^{2+}, ATP and several anions. The apparent K_m's of all four substrates show a decrease with decreasing temperature. Kinetics of substrate oxidation by H6PD suggest that the enzyme most likely functions as a G6PD. (Authors)

15814. Legendre, Pierre, Carl B. Schreck, and Robert J. Behnke (Dept. of Biol., Univ. of Colorado, Boulder, Colorado). 1972. TAXIMETRIC ANALYSIS OF SELECTED GROUPS OF WESTERN NORTH AMERICAN Salmo WITH RESPECT TO PHYLOGENETIC DIVERGENCES. Systematic Zoology, 21(3): 292-307.

Two computer-aided techniques, the clustering analysis of the Graph Theory Model and the CHARANAL program which finds a succession of characters best classifying the objects under study, were used to indicate phenotypic similarities existing within certain members of the genus Salmo. Eight characters from 104 objects consisting of 849 specimens from 44 collections representing 5 described species and unnamed forms of western North American trouts were analyzed. Results of the Graph Theory Model and CHARANAL program were almost identical, and the former clustered the same form of trout at high similarity levels. Considering only the computer-aided analyses, the Apache (unnamed), red-banded (unnamed) and Kern River (S. aguabonita gilberti) trouts seem to be a closely-linked group slightly distinct from the Gila trout (S. gilae). The California golden trout (S. a. aguabonita) joins the cutthroat trout (S. clarki) before any other group; the trouts of the "golden trout complex" are phenotypically more similar to cutthroat trout than to rainbow trout. The rainbow trout (S. gairdneri) is connected only to trout from the Rio Truchas, also a rainbow-like trout, before the lowest level of similarity. The Mexican golden trout (S. chrysogaster) is unique in that it joins the above trouts at the lowest level of similarity. Other taxonomic informations support these contentions. The taximetric analysis shows that the trout from the upper Little Kern River basin, named S. whitei, correctly should be considered a synonym of S. a. gilberti. This paper demonstrates the efficiency of the two computer programs as a method to facilitate data analysis for systematic investigation. It is, however, also an attempt to consider all the known divergent forms of endemic western trouts in a comparative study and is a step toward a sounder understanding of the phylogenies involved. (Authors)

15815. Purdom, C. E. (Fish. Lab., Lowestoft, England). 1972. INDUCED POLYPLOIDY IN PLAICE (Pleuronectes platessa) AND ITS HYBRID WITH THE FLOUNDER (Platichthys flesus). Heredity, 29(1): 11-24.

The production of triploids in plaice and plaice X flounder hybrids by cold treatment of eggs 15 minutes after fertilization was demonstrated by genetic and histological techniques. Attempts to produce tetraploids failed. Cold treatment at the time of nuclear division during the first mitosis in the fertilised egg suppressed cell division but not completion of the first mitosis. The binucleate cells so produced divided twice at the second zygote mitosis and so reinstated the normal diploid condition. The frequency of triploids was 100 percent amongst hatched larvae, and the viability of triploid embryos, larvae and juveniles appeared normal. Characters which distinguish the plaice and flounder, such as vertebral number, larval pigmentation and orientation during metamorphosis, were inherited additively in the hybrid, backcross and hybrid triploid. Few growing oocytes were observed in the ovaries of 6-month-old triploids. This contrasted markedly with the normal diploid pattern and suggests that the triploids will be sterile. Post-metamorphosis growth rate for plaice X flounder hybrids was greater than that for plaice, and the plaice X hybrid backcross was intermediate in this respect. Triploid plaice X flounder grew at the same rate as diploid hybrids, although their proportion of flounder genetic material (1/3) was less than that of the hybrid (1/2). It was concluded that triploidy per se may be responsible for the excess growth rate. (Auth. summ.)

15816. Sibert, John, and Robert R. Parker (Fish. Res. Bd. of Canada Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. A MODEL OF JUVENILE PINK SALMON GROWTH IN THE ESTUARY. Fish. Res. Bd. Canada Technical Report No. 321, 61 p.

This model was constructed in an attempt to bring together, in a quantitative way, a number of heretofore unrelated observations and measurements on the life history, feeding and growth of two species of salmon. The model simulates the growth of a population of pink salmon fry under predation by a population of growing coho salmon fingerlings during the first two months of sea life. A very simple predation model is used where the predator will strike at all potential prey but will only actually kill and eat those which are smaller than some maximum size. This maximum size, as well as the maximum daily ration, are fixed proportions of the predator's body weight. Features included in the model which can be modified to simulate different situations are: (1) "head start", the number of days by which the peak of the pink downstream migration precedes that of the coho; (2) mean length at entry of both populations; (3) growth rate of both populations; (4) length-weight relationships; (5) maximum prey size and maximum daily ration; (6) number of "hits" made by the predator before resorting to an (assumed adequate) alternate food. The numerical values as input for a "standard run" on the computer are given in the table, along with some references to the literature. The figures show an outline of the logic of the model and some representative results. A more complete description of this model is in preparation. (Authors text)

15817. Westrheim, S. J., D. R. Gunderson, and J. M. Meehan (Fish. Res. Bd. of Canada Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. ON THE STATUS OF PACIFIC OCEAN PERCH (Sebastes alutus) STOCKS OFF BRITISH COLUMBIA, WASHINGTON, AND OREGON IN 1970. Fish. Res. Bd. Canada Technical Report No. 326, 48 p.

Status of the three stocks of Pacific ocean perch is variable. The Queen Charlotte Sound stock appears to be in good shape. Biomass estimates and CPUE values indicate that it was the largest of the three stocks, and fortuitously did not receive such intensive exploitation. Recruitment of new, strong year-classes appears to be counterbalancing the more or less natural decline of the older, strong year-classes. Furthermore, fishing effort is expected to decline further after March, 1971, when Queen Charlotte Sound becomes a Canadian exclusive fishing zone. Japanese and Soviet vessels are excluded from such zones. In contrast, the high 1966-68 exploitation rates applied to the relatively small biomasses in the Vancouver and Columbia Areas have reduced stocks in these areas to critically low levels. Exploitation rates were greater in the Columbia Area, and a more rapid and drastic reduction of the stocks took place there. The new, relatively strong 1960-62 year-classes offer some hope, particularly in the Vancouver Area. However, recruitment of the 1966-70 year-classes to the fishery will likely reflect the ultimate effect on the stocks of the substantial removals during 1966-68. This recruitment will begin in 1975. (From authors summ.)

15818. Manzer, J. I. (Fish. Res. Bd. of Canada Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. ON THE RELATION BETWEEN LACUSTRINE GROWTH AND PRODUCTION OF AGE 1.2 SOCKEYE (Oncorhynchus nerka) IN GREAT CENTRAL LAKE PRIOR TO EXPERIMENTAL NUTRIENT ENRICHMENT. Fish. Res. Bd. Canada Technical Report No. 324, 31 p.

The reproductive success of age 1.2 sockeye for years prior to experimental nutrient enrichment was investigated for Great Central Lake, a nutrient-poor lake currently the site of a lake fertilization experiment. A reproduction curve developed for the stock indicates that maximal production occurred from escapements between 6,000 and 18,000 spawners, and that the escapement replacement level is approximately 33,000 spawners. Relationships between lacustrine growth, as measured by the circulus number within the completed freshwater annulus on scales from age 1.2 survivors, and escapement and return per spawner are described. It was concluded that smolts in order to return in greater numbers than their parents must, on the average, form no less than 10 circuli within the completed freshwater annulus. The maximal size of the parent population which is associated with smolts with this number of circuli is 33,000, the escapement replacement level determined from the reproduction curve. (Auth.)

15819. Narver, David W. (Fish. Res. Bd. of Canada Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. A SURVEY OF SOME POSSIBLE EFFECTS OF LOGGING ON TWO EASTERN VANCOUVER ISLAND STREAMS. Fish. Res. Bd. Canada Technical Report No. 323, 55 p.

The lack of British Columbia studies relating logging practices to salmon and trout production was the basic reason for a 1970 survey of sections of two streams on the east coast of Vancouver Island. The objective was to compare fish populations, invertebrate drift, stream temperatures and stream channel widths in recently clearcut and burned stream sections and adjacent upstream sections in standing timber. Late summer standing stock estimates of the trout population in Jump Creek was considerably greater in the timbered (2226 fish/acre and 38.8 lbs./acre) than the logged section (1420 fish/acre and 3.9 lbs./acre). The standing stock of juvenile coho salmon and steelhead in Wolf Creek ranged from 6722 fish/acre (27.9 lbs./acre) to 10,206 fish/acre (49.8 lbs./acre) with the highest density (mainly steelhead) in the logged sections. Stock estimates for these two streams are similar or higher in comparison to other stream salmonid populations reported in the literature. Other possible effects of logging revealed in this survey was fish size, stream temperature and stream channel width. A larger average size of each age group of trout in the logged section of Jump Creek compared to the timbered section may have been related to higher stream temperatures in June and July leading to faster development of pre-emergent fry and earlier emergence. Stream temperature in the logged sections were higher than in upstream timbered sections. In Jump Creek maximum temperature was 21.1°C (70.0°F) in the logged section and 15.1°C (59.2°F) in the timbered section; temperatures over 20°C (68°F) lasted only a few hours each day. The channel of both streams in the logged sections appeared badly eroded with cutbanks and wide gravel bars, but only in Wolf Creek was the channel significantly wider in the logged than in the timbered sections. (Auth.)

15820. Poluhowich, John J. (Reg. Biol. Section, Biol. Sci. Group; and Inst. of Cell. Biol., Univ. of Connecticut, Storrs, Connecticut). 1972. ADAPTIVE SIGNIFICANCE OF EEL MULTIPLE HEMOGLOBINS. Physiological Zoology, 45(3): 215-222.

The oxygenation properties of the hemolysate and the two major hemoglobin components of the eel when placed in buffers of different saline concentrations were studied. The individual hemoglobin components exhibited opposing oxygenation behavior while the oxygen equilibrium curve for the hemolysate changed little under similar conditions. It is suggested that the multiple hemoglobins serve to maintain a constant oxygen affinity of the blood during changes in ambient salinity. (Auth. summ.)

15821. Hill, Loren G., J. Larry Renfro and Randy Reynolds (Dept. of Zool., Univ. of Okla., Norman, Oklahoma). 1972. EFFECTS OF DISSOLVED OXYGEN TENSIONS UPON THE RATE OF AERIAL RESPIRATION OF YOUNG SPOTTED GAR, Lepisosteus oculatus (LEPISOSTEIDAE). The Southwestern Naturalist, 17(3): 273-278.

For young-of-year spotted gar, Lepisosteus oculatus, the ambient oxygen concentration of the water influenced the rate of aerial respiration and behavior. Aerial respiration versus ambient partial pressure of dissolved oxygen indicated a distinct negative relationship. As ambient P_{O_2} decreased, aerial-breathing increased. The rate of increase in aerial-breathing between 0 and 79 mm Hg more than doubled (0.005 breaths/hr per mm Hg, compared to P_{O_2}'s greater than 19 mm Hg). The extent at which the gar is affected by dissolved oxygen tensions may be related to many factors, in particular the gill efficiency or the oxyhemoglobin affinity. (Authors)

15822. Messieh, S. N., and A. C. Kohler (Fish. Res. Bd. of Canada Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. DISTRIBUTION, RELATIVE ABUNDANCE AND GROWTH OF LARVAL HERRING Clupea harengus L. IN THE SOUTHERN GULF OF ST. LAWRENCE. Fish. Res. Bd. Canada Technical Report No. 318, 31 p.

15823. Powers, Dennis A., and Allen B. Edmundson (Div. of Biol. and Med. Res., Argonne Nat. Lab., Argonne, Illinois). 1972. MULTIPLE HEMOGLOBINS OF CATOSTOMID FISH. I. ISOLATION AND CHARACTERIZATION OF THE ISO-HEMOGLOBINS FROM Catostomus clarkii. J. Biol. Chem., 247(20): 6686-6693.

Multiple hemoglobins from a fish (Catostomus clarkii) were separated and characterized by electrophoresis, column chromatography, ultracentrifugation, end group analysis, and oxygen equilibria studies. The hemoglobins were all tetramers of α and β chains. Two different α chains were detected in unfractionated hemoglobins. Two major β chains were isolated from the hemoglobin components which migrated electrophoretically toward the anode at pH 8.6. Two additional β chains, which were constituents of hemoglobins that migrated toward the cathode, could not be separated from the α chains. The β chains of the anodal and cathodal hemoglobin components of an individual fish were subjected to amino end group analyses with sequenator. The partial sequences of the β_A and β_B chains of the anodal components differed by $< 10\%$, a finding consistent with the presence of mixed $\alpha_2\beta_A\beta_B$ tetramers among the hemoglobins. The NH_2-terminal segments of the two β chains of the cathodal hemoglobins were also similar to each other, but differed from the β chains in the anodal components by the same order of magnitude (40 to 45%) as the α and β chains of mammalian hemoglobins. Unlike the anodal components, the cathodal hemoglobins showed no Bohr effect. The chemical groups responsible for most of the Bohr effect were absent in the α and β chains of the cathodal components. These observations were used to propose a possible role for the cathodal hemoglobins in helping to maintain intrastream niche segregation of sympatric catostomid species. (Authors summ.)

15824. Powers, Dennis A., and Allen B. Edmundson (Div. of Biol. and Med. Res., Argonne Nat. Lab., Argonne, Illinois). 1972. MULTIPLE HEMOGLOBINS OF CATOSTOMID FISH. II. THE AMINO ACID SEQUENCE OF THE MAJOR α CHAIN FROM Catostomus clarkii HEMOGLOBINS. J. Biol. Chem., 247(20): 6694-6707.

The amino acid sequence of the principal α chain in the multiple hemoglobins of the fish, Catostomus clarkii, was determined by examination of peptides released by tryptic hydrolysis and cleavage with cyanogen bromide. The sequence differed from that of the carp α chain in only 10% of the residues, but varied from mammalian α chains by 40 to 50%. However, isopolar substitution was maintained in the internal hydrophobic sites considered important for the structural integrity of mammalian globins. Residues homologous with the heme and interchain contacts of the mammalian globins were strongly conserved in the C.clarkii α chain. (Authors summ.)

15825. Møller, Dag. 1970. GENETIC DIVERSITY IN ATLANTIC SALMON AND SALMON MANAGEMENT IN RELATION TO GENETIC FACTORS. The International Atlantic Salmon Foundation Special Publication Series, 1(1): 5-29.

The existence of genetic diversity in Atlantic salmon cannot be denied; the existence of populations which are clearly different genetically has been confirmed. However, it is assumed that interchange of stocks may have affected the gene frequencies of the original populations, but they have not led to a general breakdown of the natural isolating mechanisms. Genetically distinct groups of Atlantic salmon still exist. The three objectives in management should be: 1. Keeping the number of individuals in the natural populations at the highest possible level. 2. Introduction of salmon into previously uninhabited areas. 3. The artificial maintenance of the sea run of salmon into rivers/streams which by man's occupation or by nature are useless as spawning grounds. Bases for genetic improvement of the Atlantic salmon are given.

15826. von Bonsdorff, C.-H., T. Forssten, M. K. S. Gustafsson, and B.-J. Wikgren (Inst. of Biol., Åbo Akademi, Åbo, Finland). 1971. CELLULAR COMPOSITION OF PLEROCERCOIDS OF Diphyllobothrium dendriticum (CESTODA). Acta Zoologica Fennica, No. 132, 25 p.

15827. Kruzynski, G. M., and G. Leduc (Sir George Williams Univ., Montreal, Quebec, Canada). 1972. METHOXYCHLOR, A NEW THREAT TO THE ATLANTIC SALMON. Atlantic Salmon Journal, No. 1, 5 p.; Selected Water Resources Abstracts, 5(20): p. 61, 1972.

Brook trout, Salvelinus fontinalis, were exposed for periods of up to 40 days to an artificial diet containing 0.5-100 ppm of methoxychlor. These dietary levels were chosen on the basis of methoxychlor residues found in aquatic insects which had been exposed to 0.075 mg/l of the insecticide, the standard dosage presently used on the Quebec North shore for blackfly control. Methoxychlor had little effect on the growth in length and weight but produced intermittent mortality and a reduction in swimming stamina at exposure levels of 0.01-0.16 mg/kg/day, while fish that had received 1.00 and 2.00 mg/kg/day had a markedly increased stamina. Residue determinations at the end of the exposure period revealed methoxychlor levels of 2-44 mg/kg in whole fish, while the fat bodies of fish that died during the exposure period contained up to 584 mg/kg of the insecticide. Histopathological observations revealed extensive degenerative changes in liver and kidney tissues and a lowered red blood cell count in fish which had been exposed to the insecticide.

15828. Matida, Y., H. Kumada, S. Kumura, Y. Saiga, and T. Nose (Freshwater Fish. Res. Lab., Tokyo, Japan). 1971. TOXICITY OF MERCURY COMPOUNDS TO AQUATIC ORGANISMS AND ACCUMULATION OF THE COMPOUNDS BY THE ORGANISMS. Bull. Freshwater Fisheries Res. Lab., 21(2): 197-227; Selected Water Resources Abstracts, 5(20): p. 69, 1972.

This study confirmed that fish feeding on mercury-contaminated organisms from Minamata Bay, Japan, suffer from mercury poisoning. The results of studies of chronic toxicity to fish of toxic shellfish containing some methyl mercury compounds and of various mercury compounds are discussed. In addition, the results of some experiments on biological magnification of mercury compounds through the food chain from phytoplankton to fish, and on biosynthesis of organic mercury from inorganic mercury are considered.

15829. Nakatsukasa, Yasuo (Ube-Kojo High School, Ube City, Japan). THE FIBROMA IN THE OVARY OF Oncorhynchus kisutch. Jap. J. Ichthyol., 19(1): 36-38. In Japanese with English abstract.

An ovarian tumor of Oncorhynchus kisutch (Walbaum) was studied histologically. The tumor consisted of several well-encapsulated masses and it grew expansively. There was no infiltration into the parenchyma of the ovary. The tumor was composed of spindle-shaped cells of various sizes and interlacing bundles of fibrous and connective tissue which showed whorled appearance in some areas. The tumor seems to have arisen from the stromal connective tissue of the ovary. The atrophy of ovarian eggs was observed. Judging from these facts, this tumor was identified with fibroma. (Auth.)

15830. Nakatsukasa, Yasuo (Ube-Kojo High School, Ube City, Japan). THE SUBCUTANEOUS ADENOMA IN THE SKIN OF THE "HIBUNA", Carassius auratus. Jap. J. Ichthyol., 19(1): 39-40. In Japanese with English abstract.

The multiple tumors developed on the skin of "hibuna", Carassius auratus (Linnaeus) were diagnosed as benign adenomas on the basis of histological observation and they may be developed from the mucous cells of the epidermis. (Auth.)

15831. Mugiya, Yasuo (Dept. of Biol., Fac. of Fish., Hokkaido Univ., Hokkaido, Japan). ON ABERRANT SAGITTAS OF TELEOSTEAN FISHES. Jap. J. Ichthyol., 19(1): 11-14. In English.

Aberrant sagittas of Theragra chalcogramma, Cleisthenes pinetorum herzensteini, and Salmo gairdnerii irideus are described. They are made up of abnormal portion where crystalline blocks of various sizes are piled up irregularly. The aberrant sagittas were found in either of the left or right sacculi, and in most cases those of the other side were normal. (Auth.)

15832. Maekawa, Koji, and Juro Yamada (Fac. of Fish., Hokkaido Univ., Hokkaido, Japan). 1972. MORPHOLOGICAL IDENTIFICATION AND CHARACTERIZATION OF CELLS INVOLVED IN THE GROWTH OF THE GOLDFISH SCALE. Jap. J. Ichthyol., 19(1): 1-10. In English.

Light and electron microscopic identification and characterization of cells associated with goldfish scales were made with reference to their respective functions. The cells involved in the scale growth were classified into the following four groups: small round cells surrounding the marginal osteoid zone, large flattened cells covering the calcifying osseous layer including those associated with the growth of ridges, cells found in the terminal of the groove, and cells forming laminae of the fibrillary plate. On the basis of their topography and fine structural characteristics, possible functions of the cells were discussed. A special attention was paid to the fine structure of the groove. The bottom wall of the groove was shown to be uncalcified and composed of randomly dispersed thick collagen fibers and of a densely packed substance. This feature supports the idea that it would give flexibility to the scale. (Authors)

15833. Tanaka, Masaru (Dept. of Fish., Fac. of Agric., Kyoto Univ., Kyoto, Japan). 1972. STUDIES ON THE STRUCTURE AND FUNCTION OF THE DIGESTIVE SYSTEM IN TELEOST LARVAE - IV. CHANGES IN THE EPITHELIUM RELATED TO FAT ABSORPTION IN THE ANTEROMEDIAN PART OF THE INTESTINE AFTER FEEDING. Jap. J. Ichthyol., 19(1): 15-25. In Japanese with English abstract, figs. and tables.

Study results indicate that larval plankton containing more fat are suitable as foods for teleost larvae in the early days. (From auth.)

15834. Franks, James S., J. Y. Christmas, Walter L. Siler, Ralph Combs, Richard Waller, and Charles Burns (Gulf Coast Res. Lab., Ocean Springs, Mississippi). 1972. A STUDY OF NEKTONIC AND BENTHIC FAUNAS OF THE SHALLOW GULF OF MEXICO OFF THE STATE OF MISSISSIPPI AS RELATED TO SOME PHYSICAL, CHEMICAL AND GEOLOGICAL FACTORS. Gulf Research Reports, 4(1): 148 p.

A seasonal study of the nektonic and benthic faunas of the shallow Gulf of Mexico off Mississippi was conducted from January 1967 through May 1969. Accounts of 50 invertebrate species (24,679 specimens) and 129 fishes (93,563 specimens) taken in trawl hauls are presented. Temperature and salinity data are given for all species. Relative abundance, seasonal bathymetric distributions and movements, apparent growth patterns, catch per unit of effort and various biological data are noted for the most abundant species. Renilla mulleri was the most abundant invertebrate taken in trawling. The brown shrimp, Penaeus aztecus, was second in abundance. The five most abundant species comprising 80.57% numerically of the catch were croaker, longspine porgy, butterfish, spot and seatrout. The species comprising 91.89% of the catch by weight were the croaker, longspine porgy, spot, seatrout, lizardfish, butterfish, pinfish, bank sea bass, sea catfish and black fin sea robin. The families Sciaenidae, Sparidae and Stromateidae were represented by the greatest numbers and comprised 82.9% of the total catch. Families considered to be of commercial importance contributed 92.9% to the total fish catch. (From authors)

15835. MacKenzie, William (International Atlantic Salmon Foundation, New York, New York). 1972. THE STATE-OF-ORIGIN AS GUARDIAN OF ANADROMOUS FISH. The International Atlantic Salmon Foundation, 3(1): 1-71.

---- The 1973 Law of the Sea Conference will be petitioned by states-of-origin to sanction new international fisheries legislation giving them preferential rights respecting the management and exploitation of anadromous fish at all times during their life cycle, including periods spent feeding within areas of fishing jurisdiction of other states. This proposal, developed for the International Atlantic Salmon Foundation by William H. MacKenzie, reviews the various alternatives available to the state[s]-of-origin. It systematically rejects these in favor of a new principle which provides a workable solution to a very complex problem, giving assurance that salmon stocks will not be exhausted by indiscriminate fishing, and protecting the investment of the states producing the salmon upon which the entire fishery is dependent. ---- (from Preface by W. M. Carter)

15836. Brydges, T. G. 1971. AN INTENSIVE BIOCHEMICAL SURVEY IN WESTERN LAKE ERIE. In: Proc. 14th Conf. on Great Lakes Research, p. 185-190. Univ. of Toronto, Ontario, April 19-21, 1971; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 4239, p. 5, 1972.

For information on extent, causes, and consequences of the large variations in water quality with time observed in earlier surveys, eight stations in western Lake Erie were sampled at two depths for nine consecutive days, and 13 chemical and four bacteriological tests made.

15837. Dobson, H. H., and M. Gilbertson. 1972. OXYGEN DEPLETION IN THE HYPOLIMNION OF THE CENTRAL BASIN OF LAKE ERIE, 1929 TO 1970. In: Project HYPO, p. 3-8. Canada Centre for Inland Waters Paper No. 6, and Environmental Protection Agency Technical Report TS-05-71-208-24; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 31, Summ. No. 4241, p. 5, 1972.

Information concerning oxygen values in the hypolomnion is used as an index of the rate of deoxygenation in Lake Erie. The study was confined to the Central Basin between Port Burwell and Erie in the east and Pelee Point and Sandusky in the west.

15838. Goldman, Charles R., Gerald Moshire, and Evelyne de Amerzaga. 1970. SYNOPTIC STUDY OF ACCELERATED EUTROPHICATION IN LAKE TAHOE--AN ALPINE LAKE. In: International Symposium on Water Pollution Control in Cold Climates. Inst. of Water Resources, Univ. of Alaska, College, Alaska, July 22-24, 1970, p. 1-21; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 31, Summ. No. 4243, p. 6, 1972.

The major sources of nutrients reaching Lake Tahoe and the patterns of eutrophication produced were identified by a synoptic study. Primary productivity of phytoplankton and periphyton, species composition, biomass, and biotic diversity were recorded. Benthic invertebrates were collected and their diversity determined.

15839. Veith, Gilman D., and G. Fred Lee. 1971. PCBs IN FISH FROM THE MILWAUKEE REGION. In: Proc. 14th Conf. on Great Lakes Res., Univ. of Toronto, Ontario, April 19-21, 1971, pp. 157-169; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 31, Summ. No. 4253, p. 8, 1972.

Fish from the Milwaukee River and nearshore areas of western Lake Michigan were examined for the presence of chlorobiphenyl mixtures to relate composition and quantities of these mixtures to known PCB sources or areas which have been contaminated with PCB-containing wastes.

15840. Aggus, Larry R. 1971. SUMMER BENTHOS IN NEWLY FLOODED AREAS OF BEAVER RESERVOIR DURING THE SECOND AND THIRD YEARS OF FILLING: 1965-1966. In: Reservoir Fish. and Limnol., p. 139-152. Special Publication No. 8, Amer. Fish. Soc., Wash., D. C.; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 31, Summ. No. 4295, p. 19, 1972.

The types and quantities of littoral benthic organisms found in association with selected preimpoundment vegetative complexes, measured by multiple-plate samplers and emergence traps, are described and benthic successions occurring soon after the flooding of new habitats are explored.

15841. Boyd, Claude E. 1971. THE LIMNOLOGICAL ROLE OF AQUATIC MACROPHYTES AND THEIR RELATIONSHIP TO RESERVOIR MANAGEMENT. In: Reservoir Fish. and Limnol., p. 153-163. Special Publication No. 8, Amer. Fish. Soc., Wash., D. C.; Univ. of Wisconsin Water Resources Center Eutrophication Program No. 31, Summ. No. 4296, p. 19, 1972.

Information regarding the ecology of aquatic plant infestations is discussed as a basis for encouraging management, rather than eradication, of macrophyte communities in reservoirs. Unpublished data and general observations on many reservoirs and ponds are included.

15842. Brickell, David C., and John J. Goering. 1970. CHEMICAL EFFECTS OF SALMON DECOMPOSITION ON AQUATIC ECOSYSTEMS. In: International Symposium on Water Pollution Control in Cold Climates, Inst. of Water Res., Univ. of Alaska, College, Alaska, July 22-24, p. 125-138; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 31, Summ. No. 4298, p. 19, 1972.

Initial investigations are presented on the effects of salmon carcass decomposition on the nitrogen chemistry of the water in which the decomposition occurs, the form and distribution of the organic matter which is returned to the marine system, and the rate at which remineralization occurs.

15843. Isom, Billy G. 1971. EFFECTS OF STORAGE AND MAINSTREAM RESERVOIRS ON BENTHIC MACROINVERTEBRATES IN THE TENNESSEE VALLEY. In: Reservoir Fish. and Limnol., p. 179-191. Special Publication No. 8, Amer. Fish. Soc., Wash., D. C.; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 31, Summ. No. 4302, p. 20, 1972.

The literature analyzing benthic macroinvertebrates in the Tennessee Valley over the past 50 years is reviewed. Impoundment effects on faunal assemblages and on relationship between structure and function are discussed; fauna in Clinch River above and below Norris Dam is considered as a model of TVA storage impoundments.

15844. Pageau, G., Y. Gravel, and L. Levesque. 1971. THE ICHTHYOFAUNA AND FLORA OF LAKE ST. LOUIS ON THE ST. LAWRENCE RIVER NEAR MONTREAL, QUEBEC: GENERAL FEATURES AND RECENT CHANGES. In: Proc. 14th Conf. on Great Lakes Res., Univ. of Toronto, Ontario, April 19-21, 1971, p. 79-89; Univ. of Wisconsin Water Resources Center Eutrophication Program, No. 31, Summ. No. 4309, p. 22, 1972.

The general increase of aquatic vegetation and the changes in fish populations, directly related to accelerated eutrophication, of the Great Lakes system, are reported and the literature reviewed pertaining to fish and aquatic vegetation mainly in Lake St. Louis, Near Montreal, Quebec.

15845. Donaldson, Lauren R. (Coll. of Fish., Univ. of Washington, Seattle, Washington). 1971. DEVELOPMENT OF SELECT STRAINS OF SALMONID FISHES FOR USE IN MANAGEMENT. The International Atlantic Salmon Foundation Special Publication Series, 2(1): 19-31.

An outline is given of work carried out at the College of Fisheries, University of Washington on genetic improvement of certain salmonids.

15846. Peterson, Hans (Bergerforsen Smolt Rearing Station, Sweden). 1971. SMOLT REARING METHODS, EQUIPMENT AND TECHNIQUES USED SUCCESSFULLY IN SWEDEN. The International Atlantic Salmon Foundation Special Publication Series, 2(1): 32-62.

Includes: Salmon Rearing Methods; Broodstock; Yolksac Fry; The Rearing Stage - The Troughs; Swim-up Fry; Food; The Later Part of the First Summer; First Fall and Winter; Fish Budget; Parasites and Diseases; Tagging and Release of Smolts; Release of Smolts; Transportation; Exercise; The Baltic Sea Compared to the Atlantic Ocean.

15847. Piggins, David J. (The Salmon Research Trust of Ireland, Newport, Ireland). 1971. SMOLT REARING, TAGGING AND RECAPTURE TECHNIQUES IN A NATURAL RIVER SYSTEM. The International Atlantic Salmon Foundation Special Publication Series, 2(1): 63-82.

Includes: Introduction; Parent Stock; Incubation and Early Feeding; Pond-rearing; Feeding; Growth and Mortality; Recapture Rates; Smolt Release; Selective Breeding; Smolt Marking; Trapping and Census Work; Patterns Emerging from Census Work; Conclusion.

15848. Chen, M., and G. Power (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1972. INFECTION OF AMERICAN SMELT IN LAKE ONTARIO AND LAKE ERIE WITH THE MICROSPORIDIAN PARASITE Glugea hertwigi (Weissenberg). Can. J. Zool., 50(9): 1183-1188.

In samples taken monthly throughout the year the percentage of American smelt in Lake Ontario and Lake Erie containing cysts of Glugea hertwigi was 5.2% and 62.7% respectively. Sexual differences in incidence were observed, the significance of which was uncertain as results from the two lakes were contradictory. In male fish infection was almost entirely restricted to the digestive tract with few cysts in the liver, skin, and testes. In female fish the digestive tract and ovaries were similarly infected. Seasonal fluctuations in Glugea infection were obvious and seemed correlated with the gonadal cycle. In both sexes the highest parasite load corresponded with the onset of maturation. A striking difference in fecundity between the two smelt populations was attributed to the Glugea infection. In females parasite cysts replaced ovarian tissue, causing a reduction in the number of maturing eggs. (Authors)

15849. Natochin, Yu. V., G. P. Gusev, O. A. Goncharevskaya, E. A. Lavrova, and E. I. Shakhmatova (Inst. of Evolutionary Physiol. and Biochem., Leningrad, USSR). 1972. EFFECT OF DIURETICS ON THE SECRETION AND REABSORPTION OF IONS IN THE KIDNEY OF MARINE TELEOSTS. Comp. Biochem. Physiol., 43(2A): 253-258.

Black sculpine with partly aglomerular kidneys from the Barents Sea and black sculpine with glomerular kidneys from the White Sea as well as scorpion fish and mullet from the Black Sea were injected intramuscularly with Lasix, Edecrin, Brinaldix and Diamox. The kidneys of the different species of these fish showed wide variations in their reactions to the injection of diuretics. Following injection of Lasix, Edecrin and Brinaldix, a significant increase in the Na concentration of the urine from black sculpine and mullet was observed, associated with a decrease in Mg concentration in the former and with a sharp increase in chloride concentration in the latter. In experiments performed on black sculpine after simultaneous injection with diuretics and sodium sulphate it was found that diuretics while inhibiting Na reabsorption do not affect sulphate secretion. Lasix, Edecrin and Brinaldix seem to affect primarily Na reabsorption, while the change in the urinary concentration and excretion of other ions depends on the interrelationship between the tubular transport of Na and these ions. (Authors)

15850. Perrier, Henri, C. Perrier, Y. Gudefin, and J. Gras (Dept. of Pharm. Biochem., Univ. Claude Bernard, U.E.R. of Pharm. Sci., 8 Rockefeller Ave., 69 Lyon 8e, France). 1972. ADRENALINE-INDUCED HYPERCHOLESTEROLEMIA IN THE RAINBOW TROUT (Salmo gairdnerii Richardson): A SEPARATE STUDY IN MALE AND FEMALE TROUT AND THE EFFECT OF ADRENERGIC BLOCKING AGENTS. Comp. Biochem. Physiol., 43(2A): 341-347.

Adrenaline was injected intra-muscularly at the rate of 50 μg/100 g. The increase of adrenalinemia fell rapidly and its value was quite normal after 48 hr. Free fatty acids and total protein levels in plasma did not change at any time after injection. An increase in cholesterolemia was noted after 5 and 16 hr. Male animals had a greater reactivity than females. β-Adrenergic blocking agents (propranolol and pindolol) had no influence on adrenaline-induced hypercholesterolemia. Phentolamine caused a total inhibition of adrenaline activity. (Authors)

15851. Rivers, Jerry B., James E. Pearson, and Cynthia D. Shultz (Hawaii Community Studies on Pesticides, Pacific Biomed. Res. Center, Univ. of Hawaii, Honolulu, Hawaii). 1972. TOTAL AND ORGANIC MERCURY IN MARINE FISH. Bull. of Environmental Contamination and Toxicology, 8(5): 257-266.

Total and organic mercury levels are given for the muscle tissue of certain pelagic and inshore fish of Hawaii which are used for human consumption.

15852. Linthicum, D. Scott, and Francis G. Carey (Dept. of Biol., Woods Hole Oceanographic Inst., Woods Hole, Massachusetts 02543). 1972. REGULATION OF BRAIN AND EYE TEMPERATURES BY THE BLUEFIN TUNA. Comp. Biochem. Physiol., 43(2A): 425-433.

The brain and eye of bluefin tuna (Thunnus thynnus) are warmer than the water. In fish from 20°C water, brain temperatures averaged about 27°C, eye temperatures about 26°C and maximum muscle temperatures about 30°C. Brain, eye and muscle temperatures are regulated so that there is only a 5-6°C variation over the water temperature range of 7-23°C. A counter-current heat-exchange system in the blood supply to the brain and eye allows metabolic heat to accumulate in these organs and raise their temperatures. (Authors)

15853. Dockray, Graham J., and Alan D. Pickering (Dept. of Physiol., Univ. of Liverpool, Liverpool L69 3 BX, England). 1972. THE INFLUENCE OF THE GONAD ON THE DEGENERATION OF THE INTESTINE IN MIGRATING RIVER LAMPREYS: Lampetra fluviatilis L. (CYCLOSTOMATA). Comp. Biochem. Physiol., 43(2A): 279-286.

Over a period of 3 months, degeneration and loss of weight in the intestine of gonadectomized migrating lampreys was less than in sham-operated animals. Fresh-run lampreys had trypsin levels of 8.9 μg/intestine compared with 3.5 μg in gonadectomized animals, 1.4 μg and 0.6 μg in sham-operated and spawning animals respectively. Chymotrypsin levels were similar. Levels of cholecystokinin activity were similar in fresh-run and gonadectomized animals, but reduced in sham-operated animals. It is concluded that maturation of the gonad promotes atrophy of the digestive system in lampreys; possible mechanisms are discussed. (Authors)

15854. Chidambaram, S., R. K. Meyer, and A. D. Hasler (Dept. of Zool. and Endocrinology-Reproductive Physiol. Program, Univ. of Wisconsin, Madison, Wisconsin 53706). 1972. EFFECTS OF HYPOPHYSECTOMY, PITUITARY AUTOGRAFTS, PROLACTIN, TEMPERATURE AND SALINITY OF THE MEDIUM ON SURVIVAL AND NATREMIA IN THE BULLHEAD, Ictalurus melas. Comp. Biochem. Physiol., 43(2A): 443-457.

Hypophysectomy induced hyponatremia and decreased the mean fresh water (FW) survival time to 7.0 days. Prolactin treatment or isosmotic saline maintenance of hypophysectomized fish maintained plasma sodium at the level of intact fish and prolonged survival. Hyponatremic, hypophysectomized fish maintained in FW at 11°C survived $>$ 21 days compared to 8.0 days in FW at 20°C. Autografted pituitary glands prolonged FW survival and maintained plasma sodium at presurgical concentrations for the entire experimental period of 12 days. (Authors)

15855. Kamps, Laverne R., Richard Carr, and Hanford Miller (FDA, Washington, D. C.). 1972. TOTAL MERCURY-MONOMETHYLMERCURY CONTENT OF SEVERAL SPECIES OF FISH. Bull. of Environmental Contamination and Toxicology, 8(5): 273-279.

Data are presented which show the total mercury versus monomethylmercury content in the edible portion of five species of fish. Mercury content ranged from 0.04 to 2.60 ppm. The proportion of methylmercury to total mercury ranged from 67 to 125%. Comparative data from the 36 samples analyzed show that mercury in the edible portion of these swordfish, tuna fish, northern pike, white bass and perch is essentially all monomethylmercury. (Authors summ.)

15856. Jordan, F. P., and Howard D. Smith (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. SUMMARY OF SALMON COUNTS AND OBSERVATIONS FROM THE BABINE RIVER COUNTING FENCE, 1967-1971. Fish. Res. Bd. Canada Technical Report No. 331, 63 p.

15857. Burrows, Roger E. (Salmon Cultural Lab., Longview, Washington). 1971. RECONDITIONING AND WATER RECIRCULATION TECHNIQUES FOR USE IN ATLANTIC SALMON REARING. The International Atlantic Salmon Foundation Special Publication Series, 2(1): 83-88.

15858. Hallock, Richard J., Robert F. Elwell, and Donald H. Fry, Jr. (Anadromous Fisheries Branch, Calif. Dept. of Fish and Game, Red Bluff, California). 1970. MIGRATIONS OF ADULT KING SALMON Oncorhynchus tshawytscha IN THE SAN JOAQUIN DELTA AS DEMONSTRATED BY THE USE OF SONIC TAGS. Fish Bulletin. The Resources Agency, Dept. of Fish and Game, State of California, No. 151, 92 p.

Each fall, king salmon, Oncorhynchus tshawytscha, bound for the Sacramento and San Joaquin River systems, pass through the Sacramento-San Joaquin Delta. Starting in 1961, salmon runs of the San Joaquin, but not of the Sacramento, suffered a disastrous collapse, probably due to water conditions in the San Joaquin part of the Delta. A partial recovery started in 1964. An annually recurring oxygen block caused by pollution in the southeastern part of the Delta, plus reversal of direction of flow in all three major north-south channels of the San Joaquin (southern part of the Delta) were believed responsible for the collapse. In the eastern channel, flow reversal which lasts into the salmon migration period occurs only in exceptionally dry falls such as 1961; in the other channels it occurs annually. Reversal is caused by operation of a 4,600 cfs capacity pumping plant which pulls Sacramento River water south through channels that normally carry San Joaquin water north. From 1964 through 1967, salmon tagged with sonic tags were released in the central part of the Delta to determine their reaction to low oxygen levels and reversed flows. Electronic equipment enabled us to follow tags by boat and to record their movement past fixed points. Salmon avoided water with less than 5 ppm dissolved oxygen by staying farther downstream until the oxygen block cleared. Temperatures over 66°F had a similar but less sharply defined effect. In 1964, pumped water and partial closure of one major west-flowing channel were used to force extra water through the polluted area and break up the oxygen block. At present pumping rates, this method is practical in dry years, but is not needed in normal or wet years. Relatively few fish used either of two western channels which had reversed flows but would have led them to their destination. The pattern of salmon movement is complicated by a large flow of Sacramento River water which diverts through the Delta Cross Channel and Georgiana Slough and flows successively through the Mokelumne and San Joaquin Rivers and back into the Sacramento. Some Sacramento salmon go upstream by this route. A second large pumping plant (10,000 cfs capacity) has recently been completed, and will greatly increase flow reversal problems until a closed canal system (such as the proposed Peripheral Canal) is used to conduct Sacramento River water to the two large pumping plants. (Authors)

15859. Eales, J. G. (Dept. of Zool., Univ. of Manitoba, Winnipeg, Manitoba, Canada). 1972. INFLUENCE OF INJECTION SITE ON RADIOTHYROXINE METABOLISM IN BROOK TROUT, Salvelinus fontinalis (Mitchill). Can. J. Zool., 50(11): 1337-1341.

Radiothyroxine ($^{*}T_4$) injection site (coelom, liver, eye orbit, or gut lumen) influenced disappearance of plasma protein bound radioactivity, thyroxine distribution space, and organ radioactivity uptake of brook trout. Eye injection, which is preferred for T_4 metabolic clearance studies, resulted in high bile radioactivity. Thus, previously described bile uptake of $^{*}T_4$ is not due to $^{*}T_4$ intraperitoneal injection close to enterohepatic organs. Low $^{*}T_4$ gut uptake implies limited enterohepatic $^{*}T_4$ recycling. (Auth.)

15860. Funk, James D., and Edward M. Donaldson (Fish. Res. Bd. of Canada, Vancouver Lab., Marine Dr., Vancouver, British Columbia, Canada). 1972. INDUCTION OF PRECOCIOUS SEXUAL MATURITY IN MALE PINK SALMON (Oncorhynchus gorbuscha). Can. J. Zool., 50(11): 1413-1419.

In the juvenile male pink salmon (Oncorhynchus gorbuscha) complete sexual maturity was attained by September in the year of hatching with thrice-weekly treatments of 10.0 and 1.0 μg partially purified salmon (Oncorhynchus tshawytscha) gonadotropin (SG-G100) per gram body weight. The time of onset of mitotic division of spermatogonia and the rate of spermiogenesis were accelerated in the precociously mature testes. At sexual maturity, a scattering of localizations of Δ 5-3β hydroxysteroid dehydrogenase activity was observed in the testes which

corresponded to the distribution of the interstitial cells. A stock of larger pink salmon (body weight at maturity 64.2 g) developed mature testes in the same time interval as the smaller sized individuals, but in these the gonads were four times larger. Immature Oncorhynchus tshawytscha matured more slowly and showed less 3β-ol dehydrogenase activity in response to SG-G100 than the pink salmon. (Authors)

15861. Jordan, C. M., and E. T. Garside (Dept. of Biol., Dalhousie Univ., Halifax, Nova Scotia, Canada). 1972. UPPER LETHAL TEMPERATURES OF THREESPINE STICKLEBACK, Gasterosteus aculeatus (L.) IN RELATION TO THERMAL AND OSMOTIC ACCLIMATION, AMBIENT SALINITY, AND SIZE. Can. J. Zool., 50(11): 1405-1411.

Samples of threespine sticklebacks, Gasterosteus aculeatus (L.), collected in seawater at Halifax, Nova Scotia, were acclimated to six combinations of conditions at 10 and 20C and in 0, 12, and 30 °/oo salinity (S). Bioassays of 10,000 min were performed at various constant temperatures from 20 to 30 C in the diallel combinations of acclimation and salinities of 0, 12, and 30 °/oo. Highest upper lethal temperatures, corresponding to combinations of acclimation, occurred in isosmotic test salinity of 12 °/oo. Upper lethal temperatures ranged in all tests from 28.76 to 21.63 C. A 10-degree increase in thermal acclimation resulted in increases in upper lethal temperature ranging from -0.27 to 0.77 degrees in tests conducted at 12 °/oo S and increases ranging variously from 1.45 to 3.56 degrees in tests conducted at 0 and 30 °/oo S. Upper lethal temperatures were shifted significantly by the ambient salinity but not by salinity of acclimation. Within the range of total lengths, 30-80 mm, there were no significant differences in mean lengths of dead and surviving fish in relation to acclimation temperatures and test salinities. There was no rank-correlation between order of death and total length in 15 of 18 test combinations. (Authors)

15862. Williams, Ernest H., Jr. (Dept. of Fish. and Allied Aquaculture, Agric. Exp. Sta., Auburn Univ., Auburn, Alabama 36830). 1972. PARASITIC INFESTATION OF SOME MARINE FISHES BEFORE AND AFTER CONFINEMENT IN FEEDING CAGES. Alabama Marine Resources Bull. No. 8, pp. 25-31; Commercial Fisheries Abstracts, 25(11): p. 17.

Under mariculture conditions fish parasites are an important problem. Fish that were captured for an experiment in mariculture techniques were examined for parasites. The fish were held in wire cages at stocking densities of 150 to 450 per cubic yard in a salinity range of 15 to 30 p.p.t. No massive mortalities occurred. Twenty of each of the following species were studied. Pompano (Trachinotus carolinus Linnaeus), Atlantic croaker (Micropogon undulatus Linnaeus), spot (Leiostomus xanthurus Lacépède), gafftopsail catfish (Bagre marinus Mitchill), and sea catfish (Arius felis Linnaeus). In pompano, the incidence of Trichodina species, monogenetic trematodes and cestodes increased after confinement. Digenetic trematodes, and Scyphidia species and Trichodina spp. infestations on the skin decreased. In Atlantic croaker, the numbers of monogenetic and digenetic trematodes and nematodes decreased during confinement while Trichodina increased. In gafftopsail, infestations of Trichodina spp. and Scyphidia spp. increased on the gills after confinement. On the skin, infestations of Trichodina and Vorticella spp. decreased. In sea catfish, numbers of monogenetic trematodes on the gills decreased. On the skin of the catfish, numbers of Trichodina decreased. In spot infestations of monogenetic trematodes, Trichodina, leeches, and encysted nematodes occurred on the gills. Parasites of marine fish are similar to those found in fresh-water fish. Two genera of protozoans associated with mortality in fresh-water fish culture are Scyphidia and Trichodina. Monogenetic trematodes are also a problem. Alimentary parasites such as digenetic trematodes, nematodes, and cestodes seldom cause problems. Additional research is needed to determine effective chemical treatment to control fish parasites in brackish and salt water.

15863. King, B. D., III. (Texas Parks and Wildlife Dept., Austin, Texas). 1971. STUDY OF MIGRATORY PATTERNS OF FISH AND SHELLFISH THROUGH A NATURAL PASS. Texas Parks & Wildl. Dept. Technical Series No. 9, 54 p., NOAA 2-55-R. Available from the NTIS as COM-72-10407, $3.00 in paper copy, $0.95 in microfiche; Selected Water Resources Abstracts, 5(21): p. 72.

The movements of commercially important species of fish and crustaceans through Cedar Bayou inlet, Texas were monitored to determine the spatial distribution and seasonality of each species and to identify environmental factors which cause or affect movements between oceanic and estuarine waters. The species studied included the brown, pink and white shrimps, blue crab, red drum, black drum, southern flounder, sheepshead, and spotted seatrout. Data concerning the seasonal abundance and vertical and horizontal distribution of each species are presented and the results of statistical analyses of correlated environmental variables are discussed.

15864. Kobashi, T., and Y. Deguchi (Coll. of Agric. and Vet. Sci., Nihon Univ., Tokyo, Japan). 1971. STUDIES ON THE EXCREMENTS OF THE FISH. Bull. Coll. Agric. Vet. Med. Nihon Univ. 28, pp. 92-99, illus.; Selected Water Resources Abstracts, 5(21): p. 73.

The problem of fish excrements in fish-pond management, was studied. The mucus width in excrements becomes thin in Carassius auratus, Cyprinus carpio and Carassius carassius. The number of mucus cells of the posterior intestine is more than that of the anterior intestine. Excretion time is affected by water temperature; in low water temperature excretion time becomes longer. The proportion of the excrement weight to the food weight was 5.0% in Cyprinus carpio, 6.2% in Carassius carassius and 6.8% in Carassius auratus. -- Copyright 1972, Biological Abstracts, Inc.

15865. Al-Hamed, M. I. (Div. of Hydrobiology and Fisheries, Ministry of Agric., Baghdad, Iraq). 1971. SALINITY TOLERANCE OF COMMON CARP: (Cyprinus carpio, L.). Bull. Iraq Nat. Hist. Mus. (Univ. Baghdad), 5(1): 1-7, illus.; Selected Water Resources Abstracts, 5(21): p. 74.

C. carpio, ranging in length from 8.5 to 12.7 cm were exposed directly and gradually to different salinity levels. In direct exposure experiments, fish lived at salinities as high as 12 °/oo for 10 wk (the duration of the experiment). Higher salinities proved unfavorable. In gradual acclimatization experiments during a period of 4 days fish lived at salinities as high as 17 °/oo, but higher levels were lethal. Fertilized ova of carp hatched at salinities from 2 °/oo to 10 °/oo, but the favorable level was up to 6.6 °/oo. -- Copyright 1972, Biological Abstracts, Inc.

15866. Pinkas, Leo, Malcolm S. Oliphant, and Ingrid L. K. Iverson (Marine Resources Region, Calif. Dept. of Fish and Game, Long Beach, California). 1971. FOOD HABITS OF ALBACORE, BLUEFIN TUNA, AND BONITO IN CALIFORNIA WATERS. The Resources Agency, Dept. of Fish and Game, Fish Bull. No. 152, 105 p., State of California.

The authors investigated food habits of albacore, Thunnus alalunga, bluefin tuna, Thunnus thynnus, and bonito, Sarda chiliensis, in the eastern North Pacific Ocean during 1968 and 1969. While most stomach samples came from fish caught commercially off southern California and Baja California, some came from fish taken in central California, Oregon and Washington waters. Standard procedures included enumeration of food items, volumetric analysis, and measure of frequency of occurrence. The authors identified the majority of forage organisms to the specific level through usual taxonomic methods for whole animals. Identification of partially digested animals was accomplished through the use of otoliths for fish, beaks for cephalopods, and the exoskeleton for invertebrates. A pictorial guide to beaks of certain eastern Pacific cephalopods was prepared and proved helpful in identifying stomach contents. This guide is presented in this publication. The study indicates the prominent forage for bluefin tuna, bonito, and albacore in California waters is the northern anchovy, Engraulis mordax. (Authors)

15867. Powell, Allyn B., and Frank J. Schwartz (Inst. of Mar. Sci., Univ. of North Carolina, Morehead City, North Carolina). 1972. ANOMALIES OF THE GENUS Paralichthys (PISCES, BOTHIDAE), INCLUDING AN UNUSUAL DOUBLE-TAILED SOUTHERN FLOUNDER, Paralichthys lethostigma. J. Elisha Mitchell Sci. Soc., 88(3): 155-161.

A double-tail flounder, Paralichthys lethostigma, and six instances of pigment anomalies and associated abnormalities are reported for the genus Paralichthys from North Carolina. Caudal structure of the double-tailed P. lethostigma is described. Analysis of radiographs reveal no manifest abnormalities for incomplete ambicolorates. However, total ambicolorates with incomplete eye migration and hooked dorsal fin show atypical osteological structures in the orbital region. Theories concerning inducement of ambicoloration are reviewed. (Authors)

15868. Sugimoto, Noboru, and Yasuo Yone (Fish. Res. Lab., Kyushu Univ., Tsuyazaki, Fukuoka, Japan). 1971. DISCREPANCY IN ANTIBACTERIAL POTENCY OF A NEW NITROFURAN COMPOUND BETWEEN In Vitro AND CURING INTRAMUSCULARLY INFECTED FISH. Report of Fish. Res. Lab., Kyushu Univ. No. 1, pp. 9-14. In Japanese with English abstract and tables.

A new nitrofuran compound, MKM, 1-methyl-1,4-dihydro-7-[1-methyl-2-(5-nitro-2-furyl)-vinyl]-4-oxo-1,8-naphthyridine-3-carboxylic acid potassium salt, showed a highest antibacterial potency in vitro among several drugs tested. However, the compound did not manifest so marked therapeutic effectiveness when red sea bream, Chrysophrys major, intramuscularly infected with pathogens, V. anguillarum and V. sp. (KRS), was kept in a sea water solution of MKM. This discrepancy was remarkable when compared with the other nitrofuran compound, P-7138. To account for this discrepancy, several experiments were carried out. Following a 2-hour keeping of fish in a sea water solution of MKM at 0.5- and 5-ppm levels, any detectable amount was not found in blood, liver, kidney and muscle of the fish, while in case of P-7138 was detected a considerable amount of it in those tissues. The mortality of the fish percutaneously infected with V. sp. (KRS) could be prevented by keeping the fish in a MKM solution, as contrasted to the fish intramuscularly infected. These data evidently indicate that the therapeutic effectiveness of MKM is governed by the extent of the penetration of MKM into fish tissues. The difficulty of the penetration of MKM contrary to P-7138 can be accounted for to be due to the chelating property of MKM which can be postulated from the presence of oxo- and carboxyl group in the chemical structure and was evidenced by the appearance of fluorescence when irradiated with UV light in the presence of certain metal ions. (Authors)

15869. Milne, P. H. (Dept. of Civil Engineering, Univ. of Strathclyde, Glasgow, Scotland). 1972. FISH AND SHELLFISH FARMING IN COASTAL WATERS. Fishing News (Books) Ltd., 23 Rosemount Ave., West Byfleet and 110 Fleet St., London, England, 208 p., illus., hard cover, price £7.50.

Text includes: Introduction; Fish and shellfish farming; Legal aspects of sea farming; Site selection and analysis; Selection of materials; Design and construction of shore facilities; Intertidal farming techniques; Sublittoral farming techniques; Seabed farming techniques; Floating cages and rafts; Effect of marine enclosures on environment; Control of predators; Marine pollution; Recent advances in materials and techniques, and Conclusions. (From contents)

15870. Davisson, Muriel Trask, J. E. Wright, and Louisa M. Atherton (Jackson Lab., Bar Harbor, Maine). 1972. CENTRIC FUSION AND TRISOMY FOR THE LDH-B LOCUS IN BROOK TROUT, Salvelinus fontinalis. Science, 178(4064): 992-994.

Cytogenetic analyses showed that a trisomic male brook trout of genotype BB'B'' for one of the lactate dehydrogenase subunit loci had a karyotype with two extra arms appearing as a metacentric chromosome. The metacentric chromosome probably arose through centric fusion of two acrocentric or telocentric chromosomes - one of which carried the locus for subunit B - followed by nondisjunction. (Authors)

15871. Engstrom-Heg, Robert (N. Y. State Dept. of Environmental Conservation, New York). 1971. COMPARISON OF FIELD METHODS FOR MEASURING STREAM DISCHARGE. N. Y. Fish Game J., 18(2): 77-96.

Stream discharges were measured by a modification of Embody's float method and by two salt-dilution methods using a specific conductivity meter. In one of the latter, salt solution was introduced from a plastic constant-flow carboy. In the other, salt was introduced by solution from pre-weighed salt blocks. A precise relationship between sodium chloride concentration, temperature and specific conductivity is given in nomographic form, permitting rapid determination of changes in salt concentration. Comparison with USGS stream-gage readings showed that each method, when used in a suitable location, provided discharge measurements, sufficiently accurate for most aquatic biological applications. The salt-dilution methods, in particular, can be used in very shallow, very turbulent and very sluggish streams where the more standard current-meter method is not applicable. Between them, the three methods described provide means for fairly rapid, easy, and inexpensive gaging of the great majority of small and medium-sized streams. (Auth.)

15872. Finkelstein, Samuel L. 1971. MIGRATION, RATE OF EXPLOITATION AND MORTALITY OF SCUP FROM THE INSHORE WATERS OF EASTERN LONG ISLAND. N. Y. Fish Game J., 18(2): 97-111.

A total of 3,769 scup were tagged in the Peconic Bays during the spring and summer in 1965 and 1966. Recoveries of 693 scup showed that almost 33 percent were taken by sport fishermen and more than 66 percent were caught by commercial fishermen. Recovery locations extended from Georges Bank off Massachusetts to Nags Head in North Carolina and suggest a north-south and inshore-offshore seasonal migration. Scup tagged during the summer exhibited an average exploitation rate of approximately 15 percent, an annual natural mortality rate of approximately 80 percent and a total annual mortality rate of approximately 95 percent. It is concluded that, although harvesting a greater proportion of young fish would represent better use of the resource, lowering the legal size limit (presently 7 inches) would not be practical because the smaller fish would not be marketable. (Auth.)

15873. Schneider, Clifford. 1971. SCUBA OBSERVATIONS OF SPAWNING SMALLMOUTH BASS. N. Y. Fish Game J., 18(2): 112-116.

SCUBA observations of naturally spawning smallmouth bass are described, and the behavior of the bass is compared with that reported by others. The principal difference concerned false spawning periods. (Auth.)

15874. Engstrom-Heg, Robert. 1971. DIRECT MEASUREMENT OF POTASSIUM PERMANGANATE DEMAND AND RESIDUAL POTASSIUM PERMANGANATE. N. Y. Fish Game J., 18(2): 117-122.

In natural waters treated with potassium permanganate, residual potassium permanganate and potassium permanganate demand may be measured colorimetrically after appropriate dilution and treatment with orthotolidine. Procedures and formulas are given for determinations made with a spectrophotometer-colorimeter and for field determinations made with a color comparator. (Auth.)

15875. Engstrom-Heg, Robert, and Howard A. Loeb. 1971. RECOLONIZATION OF A ROTENONE-TREATED SEGMENT OF THE TEN MILE RIVER. N. Y. Fish Game J., 18(2): 135-138.

Recolonization of the upstream 500 feet of a 2,100-foot rotenone-treated section of the Ten Mile River was studied over a 10-month period. At the end of the period, the fish population and fish biomass were estimated as 69.2 and 32.1 per cent of their respective pretreatment values. Immigrant fish of most species tended to be smaller and younger than fish of the same species in the pretreatment population. A notable exception was the American eel, the species contributing most to the fish biomass. (Authors)

15876. Loeb, Howard A., and Robert Engstrom-Heg. 1971. ESTIMATION OF ROTENONE CONCENTRATION BY BIO-ASSAY. N. Y. Fish Game J., 18(2): 129-134.

Concentration-response curves were determined for brown trout placed in water dispersions of emulsifiable rotenone. The response measured was loss of equilibrium. The values obtained yielded linear plots on logarithmic paper, when estimated threshold values were subtracted from the concentrations and response times. Linear plots were also obtained by plotting reciprocals of response times against logarithms of concentrations, using semi-logarithmic paper. The intercept of the regression line with the log concentration axis is an estimate of the threshold concentration. The curves obtained have proved to be reliable indicators of residual rotenone concentrations, particularly within the 0.05 to 0.3 ppm concentration range. (Authors)

15877. Keller, Walter T. 1971. FLOY TAG RETENTION BY SMALL BROOK TROUT. N. Y. Fish Game J., 18(2): 142-143.

Satisfactory retention of Floy tags by small brook trout is apparently dependent on tag placement to assure engagement of the interneurals.

15878. Nichols, Lacy E., Jr., and Frank J. Bulow (Tenn. Tech. Univ., Cookeville, Tennessee 38501). 1973. EFFECTS OF ACID MINE DRAINAGE ON THE STREAM ECOSYSTEM OF THE EAST FORK OF THE OBEY RIVER, TENNESSEE. J. Tenn. Acad. Sci., 48(1): 30-39.

The stream ecosystem of the East Fork of the Obey River, Tennessee was studied from January through December, 1970. Emphasis centered on water quality, macroinvertebrates, fish and aquatic flora affected by acid mine drainage. Two control stations were established within the study area, one located above the pollution zone and the other located below the zone of pollution. A reservoir station was established to detect any neutralization occurring within Dale Hollow Reservoir below the confluence of the East Fork and West Fork. An area approximately 40 miles in length was found to be severely degraded by acid mine drainage. Limited macroinvertebrate populations existed within this region. Chironomus and Sialis were the predominate benthic indicator organisms present in the polluted zone. Euglena mutabilis was the most abundant representative organism of the aquatic flora. This organism was found to be characteristic of acid mine pollution. Fish were recovered above and below, but not within, the zone of pollution. Fish recovered were characteristic of the type of habitat in which they were collected, being either typical stream or reservoir fish. A fish kill occurred in the East Fork embayment of Dale Hollow on August 15, 1970 from acid mine drainage discharged upstream. (Authors)

15879. Hutzinger, O., D. M. Nash, S. Safe, A. S. W. DeFreitas, R. J. Norstrom, D. J. Wildish, and V. Zitko (Atlantic Regional Lab., Natl. Res. Council of Canada, Halifax, Nova Scotia, Canada). 1972. POLYCHLORINATED BIPHENYLS: METABOLIC BEHAVIOR OF PURE ISOMERS IN PIGEONS, RATS, AND BROOK TROUT. Science, 178(4058): 312-314; Commercial Fisheries Abstracts, 26(1): p. 3.

Polychlorinated biphenyls (PCBs) are now known to be widespread pollutants, and they are considered to be resistant to chemical and biological degradation. Reports from previous studies indicated that chemical changes to chlorinated biphenyls were brought about by ultraviolet light; in addition, components of lower chlorine content in PCBs were metabolized by rats, pigeons, and Japanese quail but not by fish. Experiments were performed on laboratory rats, pigeons, and brook trout to determine species differences in metabolic behavior of commercial PCB preparations. The preparations included 4-chlorobiphenyl, 4,4'-dichlorobiphenyl, 2,2', 5,5'-tetrachlorobiphenyl, and 2,2',4,4',5,5'-hexachlorobiphenyl. Groups of young male rats received intraperitoneally 50 mg. of a PCB per kg. of body weight each day for 3 days. The pigeons received, in capsules, the equivalent of 60 to 100 mg/kg each day for 3 days. Each brook trout received in a single dose the equivalent of 0.460 to 1.2 g/kg concealed in chunks of beef liver. One week from the start of the experiment excreta from the pigeons and rats were collected.

The water in which the trout had been kept for 4 days was concentrated to 1 liter. Urine was acid hydrolyzed by refluxing and extracted with ether. Feces from the rats were extracted with hexane. Pigeon excreta was hydrolyzed and extracted. The liter of trout water was acidified, refluxed, and extracted with ether. By means of thin layer and gas chromatography and mass spectrometry samples of excreta extracts were analyzed. The results showed that mammalian metabolism (through hydroxylation) of chlorobiphenyls becomes more difficult as the number of chlorine atoms increased in the molecule; that is, 4-chloro-, 4,4'-dichloro, and 2,2', 5,5'-tetrachlorobiphenyl isomers were converted to mono and dihydroxylated derivatives by the rat, but no hydroxylated products of the hexachlorobiphenyl (2,2',4,4',5,5') were detected. Pigeon metabolism of these compounds was similar except that no dihydroxychlorobiphenyl was found in excreta from birds fed 4-chlorobiphenyl. There was no evidence that brook trout had metabolized PCBs by hydroxylation.

15880. Shieh, H. S., and B. H. Reddy (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1972. INCORPORATION OF [^{14}C]AMINO-ACIDS BY A FISH PATHOGEN, Aeromonas salmonicida. International Journal of Biochemistry, 3(14): 167-170; Commercial Fisheries Abstracts, 26(1): p. 6.

The causative agent of furunculosis in salmonids is A. salmonicida. It has caused severe losses in salmonid stocks throughout North America and Europe. The organism requires arginine for growth; experiments were performed to determine the role of arginine in its nutrition. The omission of arginine from the chemically defined medium results in an almost complete absence of growth of A. salmonicida. Addition of arginine to an incubation medium containing ^{14}C-labeled amino acids caused incorporation of ^{14}C into the cell protein fraction at a rate which was two to three times more than in the absence of arginine. The authors suggest that the stimulatory role of arginine in nutrition of the organism is that of an energy source.

15881. Hogan, James W., and Charles O. Knowles (Fish-Pesticide Res. Lab., U. S. Bur. Sport Fish. & Wildl., Columbia, Missouri). 1972. METABOLISM OF DIAZINON BY FISH LIVER MICROSOMES. Bull. Environmental Contamination and Toxicology, 8(1): 61-64.

Results of experiments indicate that the in vitro metabolism of diazinon is accomplished by enzyme preparations from fish liver homogenates, with the microsomal fraction being most active. The enzyme system responsible for diazinon metabolism in channel catfish liver microsomes required NADPH and oxygen for the oxidative desulfuration of diazinon to diazoxon, and probably for cleavage of diazinon and diazoxon to diethyl phosphorothioic acid and diethyl phosphoric acid, respectively. Thus, these reactions are presumed to be catalyzed by the NADPH-cytochrome P_{450} mixed function oxidase system. The only slight increase in diazinon metabolism by channel catfish hepatic microsomal or soluble enzymes with exogenous GSH suggests that GSH-dependent enzymes were not very active. (Authors' conclusions)

15882. Hansen, D. J., E. Matthews, S. L. Nall, and D. P. Dumas (Environ. Protection Agency Gulf Breeze Lab., Sabine Island, Gulf Breeze, Florida). 1972. AVOIDANCE OF PESTICIDES BY UNTRAINED MOSQUITOFISH, Gambusia affinis. Bull. Environmental Contamination and Toxicology, 8(1): 46-51.

While five of six pesticides tested were avoided by mosquitofish, dursban and 2,4-D would be most likely to produce an avoidance response in populations of these fish in the field.

15883. Fraser, J. C. (Environment Protection Authority, Victoria, Australia). 1972. REGULATED STREAM DISCHARGE FOR FISH AND OTHER AQUATIC RESOURCES - AN ANNOTATED BIBLIOGRAPHY. FAO Fisheries Technical Paper No. 112, 103 p. (Distribution restricted).

15884. Addison, R. F., G. L. Fletcher, S. Ray, and J. Doane (Fish. Res. Bd. of Canada, Mar. Ecol. Lab., Bedford Inst., Dartmouth, Nova Scotia, Canada). 1972. ANALYSIS OF A CHLORINATED TERPHENYL (AROCLOR 5460) AND ITS DEPOSITION IN TISSUES OF COD (Gadus morhua). Bull. Environmental Contamination and Toxicology, 8(1): 54-60.

An analytical procedure for Aroclor 5460, a chlorinated terphenyl, is described. Cod fed Aroclor 5460 deposited this material in various tissues. Absorptive and excretory efficiency seemed poor. Some selectivity in absorption, deposition or excretion of Aroclor 5460 was observed. (Authors summ.)

15885. Stickney, Alden P. (NMFS Biol. Lab., West Boothbay Harbor, Maine). 1972. THE LOCOMOTOR ACTIVITY OF JUVENILE HERRING (Clupea harengus harengus L.) IN RESPONSE TO CHANGES IN ILLUMINATION. Ecology, 53(3): 438-445.

The locomotor activity of juvenile herring (Clupea harengus harengus L.) was recorded in experimental tanks under natural lighting conditions and at various levels of controlled illumination. This species exhibits a diel periodicity in activity that is strongly governed by daily changes in illumination. Peaks of activity were observed shortly after sunrise and before sunset; depression of activity occurred for a limited time in continuous light or darkness; but, without the continued influence of an external light-dark cycle, this rhythm disappeared within 2 days. Maximum locomotor activity took place at an illumination of about 100 meter-candles, a level close to the natural illumination at the water surface at sunset. Since illumination decreases with depth, the times of peak locomotor activity observed in the tanks are probably earlier in the morning and later in the evening than would prevail in the natural habitat of juvenile herring at depths of 10-20 meters. (Auth.)

15886. Bertmar, Gunnar (Dept. of Biol., Section of Ecol. Zool., Univ. of Umeå, Sweden). 1972. SECONDARY FOLDING OF OLFACTORY ORGAN IN YOUNG AND ADULT SEA TROUT. Acta Zoologica, 53(1): 113-120.

The development of the olfactory rosette in parr, smolt and adult sea trout [Salmo trutta trutta L. (Mills, 1971)] is investigated by means of different fixation and staining techniques. The rosette consists of primary laminae which are folded in four types of secondary laminae. These are here called initial, cuneiform, filiform and fungiform laminae. At least initially secondary folding seems to be an interplay between a blood capillary and the sensory epithelium external to it. The ecological adaptations of folded olfactory organs are discussed. (Auth.)

15887. Davis, Paul W., Jacqueline M. Friedhoff, and Gary A. Wedemeyer (Dept. of Pharmacol., Univ. of Washington School of Medicine, Seattle, Washington). 1972. ORGANOCHLORINE INSECTICIDE, HERBICIDE AND POLYCHLORINATED BIPHENYL (PCB) INHIBITION OF NaK-ATPase IN RAINBOW TROUT. Bull. of Environmental Contamination and Toxicology, 8(2): 69-72.

Organochlorine insecticides were more effective ATPase inhibitors in rainbow trout than were herbicides. Intermediate values for enzyme inhibition were observed for PCB's.

15888. Stenersen, J., and J. Kvalvag (Norwegian Plant Protection Inst., 1432 As-NLH, Norway). 1972. RESIDUES OF DDT AND ITS DEGRADATION PRODUCTS IN COD LIVER FROM TWO NORWEGIAN FJORDS. Bull. of Environmental Contamination and Toxicology, 8(2): 120-121.

DDT residues on the average are 7.5 times higher in cod of Sognefjorden, which receives runoff from orchards sprayed with DDT, than in cod of Dalsfjorden, with no fruit growing.

15889. Wilson, Nadine, and Michael Smith (Dept. of Medicine, Univ. Southern Calif. School of Medicine, Los Angeles, California). 1971. CHANGES IN OXYTOCIC ACTIVITY OF THE HYPOPHYSIS DURING SEXUAL MATURATION OF PACIFIC SALMON, Oncorhynchus tschawytscha. General and Comparative Endocrinology, 16(2): 395-397.

15890. Moskalenko, B. K. 1971. THE WHITEFISHES OF SIBERIA. (Sigovye ryby Sibiri). Publisher: "Pishchevaya Promyshlennost'", Moscow; Translated October 1972 by Robert M. Howland, Report No. SFWFR-TR-73-05, 200 p.

This comprehensive book on the whitefishes of Siberia covers the following subjects: history of investigations; the origin and distribution of the whitefishes of Eurasia; the influence of physico-geographical factors on the formation of stocks; the pattern of migrations and seasonal distribution of the whitefishes; sexual cycles and reproduction; feeding, food resources and food interrelationships; biological characteristics of the commercial species of whitefishes - the muksun, cisco, omul', humpback whitefish, broad whitefish, peled and tugun; governmental regulation of the fishery; estimation of the stocks; basic directions of artificial propagation of the whitefishes.

15891. Eales, J. G., Linda A. Welsh, and Hooi Har Chan (Dept. of Zool., Univ. of Manitoba, Winnepeg, Manitoba, Canada). 1971. BILIARY EXCRETION OF 3, 5, 3'-TRIIODO-L-THYRONINE-^{125}I BY THE BROOK TROUT, Salvelinus fontinalis (Mitchill). General and Comparative Endocrinology, 16(2): 169-175.

The percentage of administered radioactivity occurring in several organs and in protein-bound and non-protein-bound serum fractions was measured following intraperitoneal injection of 3, 5, 3'-triiodo-L-thyronine-^{125}I (T_3*), in brook trout acclimated at 10°C. The sequence of maximum liver uptake of 8.0% within 24 hours, followed by maximum gall bladder uptake including bile of 10.9% at 48 hours and by maximum intestinal uptake including contents of 20.7% at 96 hours suggested a biliary excretion route for T_3*. By descending paper chromatography (butanol: acetic acid: H_2O, 4:1:1) most bile radioactivity occurred as two adjacent peaks (R_f 0.2-0.3) while approximately 15% corresponded to free thyronines. Bile ^{125}I-levels were negligible. T_3* loss from the serum was described by fast ($t^{1/2}$ = 6.9 hours) and slow ($t^{1/2}$ = 65.4 hours) exponents. T_3* did not appear to bind as extensively as T_4* (Eales, 1970) to serum proteins of brook trout, but both deiodination and biliary excretion seemed less pronounced for T_3* than for T_4*. (Authors)

15892. Idler, D. R., D. A. Horne, and G. B. Sangalang (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1971. IDENTIFICATION AND QUANTIFICATION OF THE MAJOR ANDROGENS IN TESTICULAR AND PERIPHERAL PLASMA OF ATLANTIC SALMON (Salmo salar) DURING SEXUAL MATURATION. General and Comparative Endocrinology, 16(2): 257-267.

Testicular and peripheral blood was removed from male Atlantic salmon (Salmo salar) during two histologically distinct stages of their sexual development. Histological examination showed the earlier fish to be in an advanced maturing stage, as sperm cells at all stages of development were present in the testis lobules, and the later fish in the fully mature spawning stage. Testosterone, 11β-hydroxy-testosterone and 11-ketotestosterone were quantified in the plasma by a double isotope derivative assay procedure. 11-ketotestosterone was the major androgen in both testicular and peripheral plasma and the concentration increased substantially as maturation advanced. Testosterone levels, in peripheral plasma, remained comparatively stable but there was a trend toward increased levels in testicular plasma. The quantities of 11-ketotestosterone and testosterone were greater in the testicular than in the peripheral plasma, indicating that the testis is the primary site of their production. In addition, substantial amounts of 11-ketotestosterone, testosterone, and 11β-hydroxytestosterone were present as glucuronosides was generally higher in testicular than peripheral plasma is direct evidence that these conjugates are produced in the testes. The concentration of 11-ketotestosterone and 11β-hydroxytestosterone glucuronosides was high in the more mature fish, but testosterone glucuronoside changed very little in concentration. 11β-Hydroxytestosterone was isolated and identified in Atlantic salmon plasma for the first time. Its concentration in testicular plasma increased in the late stages of maturation; this observation is consistent with the conclusion based on in vitro incubations that 11β-hydroxytestosterone is a precursor of 11-ketotestosterone in testis.

15893. Pakkala, Irene S., Merrie N. White, Donald J. Lisk, George E. Burdick, and Earl J. Harris (Pesticide Residue Lab., Cornell Univ., Ithaca, New York). 1972. ARSENIC CONTENT OF FISH FROM NEW YORK STATE WATERS. N. Y. Fish Game J., 19(1): 12-31.

A survey of 471 fish sampled in 1969 from 49 New York State waters for total arsenic content is presented. Arsenic levels ranged up to about 0.5 ppm with fish from Lake Ontario, Canandaigua Lake and the Hudson, St. Lawrence and Salmon Rivers being relatively higher. Larger fish generally contained higher arsenic concentrations. Arsenic did not appear to be cumulative with increasing age in lake trout ranging from 2 to 11 years old. (Authors)

15894. Engstrom-Heg, Robert. 1972. KINETICS OF ROTENONE-POTASSIUM PERMANGANATE REACTIONS AS APPLIED TO THE PROTECTION OF TROUT STREAMS. N. Y. Fish Game J., 19(1): 47-58.

Rates of rotenone detoxification by potassium permanganate were estimated by arresting the reaction with tannic acid and estimating rotenone residues by bioassay. At rotenone concentrations up to 50 ppb (1 ppm 5 percent emulsifiable product), detoxification occurs at a negative exponential rate directly proportional to the potassium permanganate concentration. Other rates are characteristic of higher concentration ranges. At any given rotenone concentration, detoxification time is inversely proportional to potassium permanganate concentration. Temperature has little effect on detoxification rates. Rates for given potassium permanganate and rotenone concentrations are slightly slower in hard than in soft water. Colloidal rotenone in saturated or freshly prepared dispersions is more difficult to detoxify than dissolved rotenone. Correction factors are given for hard water and for water containing organic material. Detoxification criteria are those for trout. Detoxification need not progress as far for centrarchids. Sodium thiosulfate may be used to treat toxic concentrations of potassium permanganate in streams. (Auth.)

15895. LeTendre, Gerard C., Clifford P. Schneider, and Neil F. Ehlinger. 1972. NET DAMAGE AND SUBSEQUENT MORTALITY FROM FURUNCULOSIS IN SMALLMOUTH BASS. N. Y. Fish Game J., 19(1): 73-82.

To determine if trap netting was related to the occurrence of lesions and furunculosis in smallmouth bass, bass were netted in Wilson Bay (Lake Ontario) and placed in a holding net, after which, at different intervals, sample fish were transported to the Cape Vincent Fisheries Station for further observation and subsequent analysis. The findings indicate that the causative agent of furunculosis (Aeromonas salmonicida) can be contracted by smallmouth bass held in trap nets for 2 to 10 days and that the longer they are held the greater the probability. (Authors)

15896. Smith, David B. 1972. AGE AND GROWTH OF THE CISCO IN ONEIDA LAKE, NEW YORK. N. Y. Fish Game J., 19(1): 83-91.

Age and growth determinations were made from scales of ciscoes collected from 1960 to 1970. A false annulus occurred each calendar year during the months of highest water temperature and lowest dissolved oxygen levels. Predominance of ages I and II ciscoes indicated high mortality rates in the population. Possible causes of false annulus formation and the high mortality rate are discussed. (Auth.)

15897. Ho, Ju-shey (Dept. of Biol., California State Univ., Long Beach, California). 1972. COPEPOD PARASITES OF CALIFORNIA HALIBUT, Paralichthys californicus (Ayres), IN ANAHEIM BAY, CALIFORNIA. J. Parasit., 58(5): 993-998.

Three species of cyclopoids (Acanthochondria sp., Holobomolochus prolixus (Cressey) and Taeniacanthodes haakeri sp. n.) and one species of caligoid (Lepeophtheirus bifidus Fraser?) were recovered from California halibut, Paralichthys californicus (Ayres), caught in Anaheim Bay, California, an area used by the host fish as a nursery. Acanthochondria sp. and L. bifidus? are not treated due to certain technical problems. The female H. prolixus is redescribed and the male, described for the first time. T. haakeri is described from the female. (Auth.)

15898. Khalil, L. F. 1971. CHECK LIST OF THE HELMINTH PARASITES OF AFRICAN FRESHWATER FISHES. Tech. Comm. No. 42, Commonwealth Inst. Helm., St. Albans, Commonwealth Agric. Bureaux, Burgess and Son, Ltd., Abingdon, Berkshire, England, XI + 80 p., $5.20; Book review by Glenn L. Hoffman in: J. Parasit., 58(5): p. 884.

In spite of the fact that fresh water covers about 74,000 square miles of Africa, surprisingly little work has been done on the helminth parasites of African fishes. This well written and documented book consists of excellent parasite/host and host/parasite check lists followed by indices of parasites and countries. As the author stated, "It is hoped that this list, combined with the increasing recognition of the importance of fish as a source of protein and, therefore, of the significance of potential pathogens, will provide the necessary stimulus to research workers to rectify these gaps." In addition, this book will provide information for workers in other countries to aid them in finding the African literature on identical and related taxa of their countries. -- Glenn L. Hoffman

15899. Mackiewicz, John S. (State Univ. of New York at Albany, Albany, N. Y.). 1970. Edlintonia ptychocheila gen. n., sp. n. (CESTOIDEA: CAPINGENTIDAE) AND OTHER CARYOPHYLLID TAPEWORMS FROM CYPRINID FISHES OF NORTH AMERICA. Proc. Helm. Soc. Wash., 37(1): 110-118.

Schell's caryophyllid is described from the intestine of the freshwater fish Ptychocheilus oregonense (Richardson) and Mylocheilus caurinus (Richardson) from British Columbia, Canada and Idaho, United States. Edlintonia is morphologically close to Adenoscolex Fotedar, of Kashmir, but has an external seminal vesicle absent in the latter genus. A comparative table of diagnostic features and a simplified key to genera of the Capingentidae are presented. All other records of caryophyllids from minnows (Cyprinidae) in North America are tabulated. Other North American Capingentidae are illustrated. (Auth.)

15900. Martin, W. E., and David F. Steele (Biol. Dept., Univ. of Southern California, California). 1970. Ascocotyle sexidigita sp. n. (TREMATODA: HETEROPHYIDAE) WITH NOTES ON ITS LIFE CYCLE. Proc. Helm. Soc. Wash., 37(1): 101-104.

The new species Ascocotyle sexidigita is described from Southern California. Naturally infected killifish, Fundulus parvipinnis parvipinnis (Girard), harbored the metacercariae in the stomach and intestinal wall. Metacercariae were fed to hatchery-raised chicks and all of them served as hosts to the adult worms. The worms developed in the ceca of the chicks which they reached within twenty-four hours after feeding. They required about six days to become egg bearing. A. sexidigita differs from all species in the genus in the nature of the gonotyl which bears six digits supported by what appear to be calcareous deposits. (Authors)

15901. Kritsky, D. C., and P. D. Leiby (Dept. of Biol., Minot State College, Minot, North Dakota). 1971. STUDIES ON HELMINTHS OF NORTH DAKOTA. I. TWO NEW MONOGENETIC TREMATODES OF THE GENUS Gyrodactylus FROM PERCID FISHES AND A REDESCRIPTION OF G. etheostomae Wellborn and Rogers, 1967. Proc. Helm. Soc. Wash., 38(2): 200-202.

Two new species of Gyrodactylus are described from percid fishes in North Dakota: G. schmidti from the walleye, Stizostedion vitreum (Mitchill); and G. mizellei from S. vitreum and the sauger, S. canadense (Smith). The finding of G. etheostomae Wellborn and Rogers, 1967, on the mud darter, Etheostoma asprigene (Forbes), from North Dakota constitutes new host and locality records for this trematode; G. etheostomae is redescribed. (Authors)

15902. Cronin, L. Eugene (Chesapeake Biol. Lab., Solomons, Maryland). 1970. GROSS PHYSICAL AND BIOLOGICAL EFFECTS OF OVERBOARD SPOIL DISPOSAL IN UPPER CHESAPEAKE BAY. Natural Resources Inst., Univ. of Maryland, Special Report No. 3, 66 p.

Contents: Summary, Conclusions and Recommendations; Geology and Hydrography; Phytoplankton; Benthos; Zooplankton; Fish Eggs and Larvae; Fish; Appendix: Publications and Reports.

15903. Suydam, E. Lynn (Parasitol. Section, Va. Inst. of Mar. Sci., Gloucester Point, Virginia). 1971. THE MICRO-ECOLOGY OF THREE SPECIES OF MONOGENETIC TREMATODES OF FISHES FROM THE BEAUFORT-CAPE HATTERAS AREA. Proc. Helm. Soc. Wash., 38(2): 240-246.

Three species of fishes, Urophycis regius, Stenotomus chrysops, and Orthopristis chrysopterus were found to be parasitized by Diclidophora maccallumi, Microcotyle stenotomi and Pseudotagia cupida, respectively. A fourth species of fish, Peprilus triacanthus, was not found to be parasitized. The branchial baskets of each species of fish were divided into arbitrary regions and the number of parasites in each region was determined. Site specificity was determined by application of Chi-square tests to the data. Diclidophora maccallumi, the only parasite to occur in sufficient number to be tested, showed site specificity. The specific sites of attachment were correlated with the mechanisms of branchial irrigation, and it was suggested that indicated site specificity may be the result of the force and direction of the gill ventilating current. (Auth.)

15904. Maggenti, A. R. (Dept. of Nematol., Univ. of Calif., Davis, California). 1971. A REVIEW OF THE FAMILY CUCULLANIDAE Cobbold, 1864 AND THE GENUS Bulbodacnitis Lane, 1916 WITH A DESCRIPTION OF Bulbodacnitis ampullastoma sp. n. (NEMATODA: CUCULLANIDAE) FROM Salmo gairdnerii Richardson. Proc. Helm. Soc. Wash., 38(1): 80-85.

The family Cucullanidae is reviewed and a key to genera is given. The genus Bulbodacnitis is reviewed, a key to species is included. A new species Bulbodacnitis ampullastoma is described. Several new combinations are proposed. (Auth.)

15905. Kennedy, C. R. (Dept. of Biol. Sci., The University, Exeter, England). 1972. THE EFFECTS OF TEMPERATURE AND OTHER FACTORS UPON THE ESTABLISHMENT AND SURVIVAL OF Pomphorhynchus laevis (ACANTHOCEPHALA) IN GOLDFISH, Carassius auratus. Parasitology, Vol. 65, Part 2, pp. 283-294.

Goldfish were experimentally infected with different population densities of the acanthocephalan Pomphorhynchus laevis, and maintained at different temperatures. The density of infection had no effect upon the establishment of the parasite, but a 12°C rise in water temperature reduced the recovery after one week by 30%. Thereafter there was a continuous loss of parasites during the course of infection. The rate of this loss was independent of worm burden and temperature, but increased under conditions of host starvation. Both male and female parasites attached themselves in the same region of the alimentary tract, with a mean position about 19% along its length. They remained in that region throughout the course of infection, and the population did not migrate down the intestine with increasing age. In starved fish, the region of attachment was nearer the oesophagus, at low temperatures nearer the rectum, and when crowded the occupied region extended anteriorly. Male worms were unable to establish as easily as females, but once established survived better, and the sex ratio after two weeks was in favor of males. The results are compared with the results of studies on other acanthocephalans and on fish-cestode systems. It is recognized that although the establishment of fish acanthocephala is affected by temperature to a lesser extent than that of some fish cestodes, temperature in conjunction with changes in fish diet is a major control upon the flow of parasites through acanthocephalan-fish parasite systems. The significance of the results to the interpretation of data based on field observations is discussed. (Auth. summ.)

15906. Wilson, Mildred Stratton (Inst. of Mar. Sci., Univ. of Alaska and Smithsonian Inst., Anchorage, Alaska). 1972. COPEPODS OF MARINE AFFINITIES FROM MOUNTAIN LAKES OF WESTERN NORTH AMERICA. Limnol. & Oceanogr., 17(5): 762-763.

Occurrences of Limnocalanus macrurus, Senecella calanoides, a variation of Mesochra rapiens and Huntemannia lacustris, all copepods either euryhaline or related to marine forms, are recorded from lakes in the Cascade and Rocky Mountains, western North America. (Auth.)

15907. Horne, Alexander J., and Charles R. Goldman (Clear Lake Algal Res. Unit, Inst. of Ecol., and Div. of Environ. Studies, Univ. of Calif., Davis, California). 1972. NITROGEN FIXATION IN CLEAR LAKE, CALIFORNIA. I. SEASONAL VARIATION AND THE ROLE OF HETEROCYSTS. Limnol. & Oceanogr., 17(5): 678-692.

The annual contribution of N_2 fixation to Clear Lake in 1970 was about 550 tonnes, 500 Mg (megagrams) or 18 kg ha^{-1}, 43% of the lake's yearly nitrogen inflow. Biological N_2 fixation can provide the nitrogen for almost half the blue-green algal standing crop during blooms and is implicated as the main cause of large algal nuisance blooms on this lake. The large quantity of nitrogen fixed may be typical for large, shallow, cyanophycean-dominated lakes. A sustained spring peak of fixation was associated with a simultaneous bloom of Aphanizomenon flos-aquae in all three basins, an autumn peak with an ephemeral bloom of Anabaena circinalis occurring at a different time in each basin. A stepwise multiple regression analysis showed that fluctuations in N_2 fixation were best described by variations in heterocysts, quantities of blue-green algae, PO_4-P, NO_3-N, and temperature. Annual rates of N_2 fixation were correlated with the proportion of heterocysts to vegetative cells in Aphanizomenon and with total number of heterocysts in Anabaena. Previous nitrogen budgets for Clear Lake have shown a large excess of nitrogen in outflow over inflow, which is accounted for by the levels of N_2 fixation measured. (Authors)

15908. Horne, Alexander J., J. E. Dillard, D. K. Fujita, and C. R. Goldman (Clear Lake Algal Res. Unit, Inst. of Ecol., Univ. of Calif., Davis, California). 1972. NITROGEN FIXATION IN CLEAR LAKE, CALIFORNIA. II. SYNOPTIC STUDIES ON THE AUTUMN Anabaena BLOOM. Limnol. & Oceanogr., 17(5): 693-703.

Nitrogen fixation at three stages of an autumnal bloom of Anabaena circinalis was measured after almost simultaneous collection at up to 32 stations in Clear Lake and algal heterocysts, phytoplankton cell numbers, NO_3-N, NH_4-N, dissolved organic-N, PO_4-P, Fe, primary production, particulate carbon, and chlorophyll-a were also measured. Nitrogen fixation was significantly and positively correlated to Anabaena heterocyst numbers ($P > 0.001$), negatively correlated to NO_3-N ($P > 0.01$), and positively correlated to dissolved organic-N ($P > 0.01$) and PO_4-P ($P > 0.05$). A negative correlation with NH_4 is probable; no significant relationship was found with the other variables measured. An explanation of the apparent restriction of substantial cyanophycean N_2 fixation to nonoligotrophic waters is proposed. The results are consistent with the theory that heterocysts are responsible for N_2 fixation in situ under oxic conditions. (Authors)

15909. Hanek, George and C. H. Fernando (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1972. MONOGENETIC TREMATODES FROM THE BAY OF QUINTE AREA, ONTARIO. III. GENERA Actinocleidus, Cleidodiscus, Urocleidus, and Tetraoncus. Canad. J. Zool., 50(10): 1303-1312.

In the present, the third in a series of papers on Monogenea from the Bay of Quinte area, 20 species of the subfamily Ancyrocephalinae Bychowsky, 1937 and one species of the family Tetraoncidae Bychowsky, 1957 are presented. The 21 species of the monogenetic trematodes collected are as follows: Actinocleidus fusiformis (Mueller, 1934) Mueller, 1937, A. gibbosus Mizelle and Donahue, 1944, A. mizellei sp. n., A. recurvatus Mizelle and Donahue, 1944, Cleidodiscus alatus Mueller, 1938, C. capax Mizelle, 1936, C. glenorensis sp. n., C. pricei Mueller, 1936, C. robustus Mueller, 1934, C. stentor Mueller, 1937, C. vancleavi Mizelle, 1936, Urocleidus acer (Mueller, 1936) Mizelle and Hughes, 1938, U. adspectus Mueller, 1936, U. dispar (Mueller, 1936) Mizelle and Hughes, 1938, U. ferox Mueller, 1934, U. fundulus Mizelle, 1940, U. furcatus (Mueller, 1937) Mizelle and Hughes, 1938, U. hargisi sp. n., U. principalis (Mizelle, 1936) Mizelle and Hughes, 1938, U. rogersi sp. n., and Tetraoncus monenteron Diesing, 1858. Descriptions and drawings of the new species and comprehensive measurements of the remaining species are presented. (Authors)

15910. Hanek, George, and C. H. Fernando (Dept. of Biol., Univ. of Waterloo, Waterloo, Ontario, Canada). 1972. MONOGENETIC TREMATODES FROM THE BAY OF QUINTE AREA, ONTARIO. IV. GENUS Dactylogyrus Diesing, 1850, WITH PROVISIONAL HOST-PARASITE AND PARASITE-HOST LISTS. Canad. J. Zool., 50(10): 1313-1317.

In this fourth and final paper on the monogenetic trematodes from the Bay of Quinte area, Ontario, the genus Dactylogyrus Diesing, 1850 is studied. Host-parasite and the parasite-host lists of the monogenetic trematodes recovered during the entire survey are presented. (Authors)

15911. Lester, R. J. G. (Dept. of Zool., Univ. of British Columbia, Vancouver, British Columbia, Canada). 1972. ATTACHMENT OF Gyrodactylus TO Gasterosteus AND HOST RESPONSE. J. Parasit., 58(4): 717-722.

Gyrodactylus alexanderi (Mizelle and Kritsky, 1967) initially uses its marginal hooklets to cling to the surface of Gasterosteus aculeatus leiurus. Tension on muscles associated with the hooklets then causes the anchors to sink into the epidermis, compressing the epidermal cells rather than piercing them. When strong shearing forces are exerted on the fluke, e.g., by fish movement, the anchors gaff the epidermis and prevent the haptor from being torn free. When shearing forces are absent, the anchors do not have this effect and the haptor is held close to the fish by the marginal hooklets alone. Healthy sticklebacks carrying 100 or more flukes shed a layer of mucoid material about 1μ thick every 1 to 2 days. When this is shed, flukes are removed with it, apparently because the hooklets are attached to this slough instead of the surface of the epidermis. (Auth.)

15912. Kritsky, D. C., P. D. Leiby, and M. E. Shelton (Dept. of Biol., Minot State College, Minot, North Dakota). 1972. STUDIES ON HELMINTHS OF NORTH DAKOTA. IV. PARASITES OF THE RIVER CARPSUCKER, Carpiodes carpio, WITH DESCRIPTIONS OF THREE NEW SPECIES (MONOGENEA). J. Parasit., 58(4): 723-731.

Three trematodes (Monogenea: Dactylogyridae), Anonchohaptor muelleri, Icelanonchohaptor microcotyle, and Pellucidhaptor micracanthus spp. n., are described from Carpiodes carpio (Raf.) from the Missouri River in North Dakota and South Dakota. The generic diagnoses of Anonchohaptor Mueller, 1938, and Pellucidhaptor Price and Mizelle, 1964, are emended. The finding of Gyrodactylus dakotensis Leiby et al., 1972, Neodiscocotyle carpioditis Dechtiar, 1967, P. eremitis Rogers, 1967 (monogenetic trematodes), and Camallanus ancylodirus Ward and Magath, 1916 (nematode), from C. carpio constitute new host records. Also, 7 new locality records are established, 6 of which are reported for the first time from the upper Missouri River. (Authors)

15913. Peeke, Harman V. S., and Shirley C. Peeke (Univ. of Calif., and Langley Porter Neuropsychiatric Inst., San Francisco, California). 1972. HABITUATION, REINSTATEMENT AND RECOVERY OF PREDATORY RESPONSES IN TWO SPECIES OF TELEOSTS, Carassius auratus AND Macropodus opercularis. Animal Behavior, 20(2): 268-273.

The tendency for predatory responses to habituate and to be reinstated through sensitization and the passing of time was studied in two species of fish (the goldfish and the paradise fish). Prey (live brine shrimp), confined in a clear plastic tube were presented for short daily exposures to individual fish. Bites directed at the stimulus tube containing the prey were the primary response measure. In both species biting decreased significantly over the 6 days of the experiment. Reinstatement of the habituated response occurred by two means: (1) reinforcement (i.e. allowing the fish to chase and consume the prey), and (2) passing of time (10 days) with no intervening stimulation (recovery). Reinstatement could not be produced by presenting a novel stimulus, nutritive stimuli, nor by a shorter recovery interval. (Authors)

15914. Hammond, Paul B., Ian C. T. Nisbet, and Adel F. Sarofim (College of Veterinary Medicine, Univ. of Minnesota, St. Paul, Minnesota). 1972.

POLYCHLORINATED BIPHENYLS - ENVIRONMENTAL IMPACT. A REVIEW BY THE PANEL ON HAZARDOUS TRACE SUBSTANCES, MARCH, 1972. Environmental Research, 5(3): 249-362.

This report reviews and assesses the information about the properties, environmental occurrence and biological effects of PCB's available in January, 1972. It pays special attention to pointing out significant gaps in our knowledge about PCB's, and recommends a number of these areas for priority in future studies. Table of Contents: Preface; Summary and General Recommendations; Properties, Production and Uses; Transport and Transformation in the Environment; Environmental Occurrence and Human Exposure; Toxic Impurities; Biological Effects; Analytical Methods; Appendix. Transport Models and Monitoring Schemes; References.

15915. Denton, E. J., and R. L. Saunders (Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. ON THE ORGANIZATION OF SILVERY LAYERS IN THE SKIN OF THE ATLANTIC SALMON (Salmo salar) DURING SMOLTIFICATION ANL ON THE REGENERATION OF THESE LAYERS UNDER ABNORMAL LIGHTING CONDITIONS. J. Mar. Biol. Assn. U.K., 52(4): 889-898.

The reflecting layers in the external surfaces of salmon were studied during smoltification by making direct observations on the reflecting structures. The relationships between the reflecting layers in the epithelium external to the scales, in the tissues of the scales, and in the skin internal to the scales are given. Some fish, including fish blinded by pseudobranchectomy were reared under very abnormal lighting conditions and the processes of silvering and regeneration of scales followed on them. It was found that the pattern of silvering in smoltification and regeneration was not at all affected by lighting and that, although regenerated scales can easily be distinguished in other ways from those they replace, the orientations and reflectivities of their platelets are, with occasional exceptions, almost indistinguishable from those they replace. (Authors)

15916. Denton, E. J., and R. L. Saunders (Biol. Sta., St. Andrews, New Brunswick, Canada). 1972. OSMOTIC PROPERTIES OF THE EPITHELIAL LAYERS COVERING SCALES OF HERRING (Clupea harengus) AND ATLANTIC SALMON (Salmo salar). J. Mar. Biol. Assn. U.K., 52(4): 899-902.

An account is given of the effects of changes of concentration of salts in the ambient medium on the colours reflected by the scales of herring and salmon. These lead to the conclusions (1) that in the herring in life the reflecting cells which lie under the scales and outside the scale pocket are in osmotic equilibrium with the external medium and not with the fish's body fluid (2) that the corresponding cells which lie inside the scale pocket of herring are always in equilibrium with these body fluids (3) that in the salmon all parts of the scale, including the parts outside the scale pocket, are in equilibrium with the internal body fluid and osmotically protected from the external medium. (Authors)

15917. Jones, A. (Fish. Lab., Lowestoft, Suffolk, England). 1972. STUDIES ON EGG DEVELOPMENT AND LARVAL REARING OF TURBOT, Scophthalmus maximus L., AND BRILL, Scophthalmus rhombus L., IN THE LABORATORY. J. Mar. Biol. Assn. U.K., 52(4): 965-986.

Methods are described for rearing turbot (Scophthalmus maximus L.) and brill (Scophthalmus rhombus L.) to late larval stages; the major part of the work was done on the former species. Turbot were reared to 16.0 mm and brill to 17.0 mm in length. Rearing tanks ranged in capacity from 8 to 60 l. Turbot larvae hatched at 2.7-3.0 mm and successful first feeding was established on rotifers (Brachionus plicatilis) at a length of 3.6-3.8 mm; larvae were transferred to a diet of Artemia nauplii at 5.6-6.0 mm. Experiments on the effect of temperature on growth and yolk absorption rates in yolk-sac turbot larvae showed optimal growth efficiency at 15.0°C. Delayed initial feeding reduced subsequent survival. Drawings of larvae development of turbot and brill were made as an aid to their identification in plankton samples. (Auth.)

15918. Upadhyay, Shakti N., and Sardul S. Guraya (Dept. of Zool., Univ. of Udaipur, Udaipur, Rajasthan, India). 1971. HISTOCHEMICAL OBSERVATIONS ON THE INTERSTITIAL TISSUE OF FISH TESTIS. General and Comparative Endocrinology, 16(3): 504-510.

A histochemical study has been made of the testicular interstitial tissue of the marine teleost (Belone belone) during the breeding season. The interstitial tissue lying in between the lobules consists of compressed stromal elements having very little cytoplasm, which do not develop the morphological and histochemical features of steroid gland cells of mammalian ovary and testis. However, the lobule boundary cells are greatly hypertrophied. They show abundant cytoplasm, and they develop the morphological and histochemical features of steroid-secreting cells. These histochemical features are the presence of diffuse sudanophilic lipoproteins and deeply sudanophilic lipid droplets consisting of either phospholipids, or phospholipids and triglycerides. The functional significance of these histochemical features of lobule boundary cells in the teleost testis is discussed in the light of recent researches carried out on the steroid-producing cells in the mammalian ovary and testis. These comparisons have suggested that the lobule boundary cells of the teleost testis are the steroid secretors. (Authors)

15919. Sundararaj, Bangalore I., S. K. Nayyar, T. C. Anand, and Edward M. Donaldson (Dept. of Zool., Univ. of Delhi, Delhi-7, India). 1971. EFFECTS OF SALMON PITUITARY GONADOTROPIN, OVINE LUTEINIZING HORMONE, AND TESTOSTERONE ON THE TESTES AND SEMINAL VESICLES OF HYPOPHYSECTOMIZED CATFISH, Heteropneustes fossilis (Bloch). General and Comparative Endocrinology, 17(1): 73-82.

Response of the regressed testes and seminal vesicles was studied after 30-day treatment with partially purified salmon gonadotropin (SG), ovine luteinizing hormone (LH), and testosterone in 237-day hypophysectomized catfish. Daily treatment with SG (0.1, 1, 10, and 100 μg) and LH (1, 10, and 50 μg) produced a dose-dependent response in the testes and seminal vesicles. A dose of 1 μg of SG reinitiated spermatogenesis, whereas a dose of 100 μg of SG not only fully restored spermatogenesis but also induced spermiation. Treatment with 10 μg of LH produced a spermatogenic response in the testes and secretory activity in the seminal vesicles comparable to those induced by 1 μg of SG. A dose of 50 μg of SG and 100 μg of testosterone were equipotent in inducing spermatogenesis in the testes and secretory activity in the seminal vesicles. LH and testosterone at the dose levels used did not induce spermiation. The possibility of one functional gonadotropin regulating the whole maturation phenomenon in the male catfish is discussed. (Authors)

15920. Hayashida, Ted (Dept. of Anat. and the Hormone Res. Lab., Univ. of Calif., San Francisco Medical Center, San Francisco, California). 1971. BIOLOGICAL AND IMMUNOCHEMICAL STUDIES WITH GROWTH HORMONE IN PITUITARY EXTRACTS OF HOLOSTEAN AND CHONDROSTEAN FISHES. General and Comparative Endocrinology, 17(2): 275-280.

The results of the present investigation suggest that growth hormone (GH) in extracts of pituitaries from representatives of the two existing genera of holostean fish, the bowfin (Amia) and the gar (Lepisosteus), and in an extract of pituitaries of a chondrostean fish (Polypterus), shows significant immunochemical relatedness to mammalian (rat) GH and appears to be capable of stimulating growth in the mammal on the basis of the tibia test in the rat. These findings are analogous to those previously reported for GH in pituitary extracts of two other chondrostean fish, the sturgeon and the paddlefish, but are in direct contrast to the negative results obtained with pituitary extracts of modern bony fish (teleostean). The findings to date indicate that a general correlation appears to exist between the immunochemical relatedness of fish GH with respect to mammalian (rat) GH, the ability of that fish GH to stimulate growth in the mammal (rat tibia test) and the general degree of development of the median eminence in the particular species from which the GH originates. (Auth.)

15921. Weisbart, Melvin, and D. R. Idler (Fish. Res. Bd. of Canada, Halifax Lab., Halifax, Nova Scotia, Canada). 1971. IDENTIFICATION AND QUANTIFICATION OF CORTICOSTEROIDS IN THE ATLANTIC HALIBUT, Hippoglossus hippoglossus L. General and Comparative Endocrinology, 17(3): 416-423.

Cortisol and cortisone were definitively identified in the plasma of the Atlantic halibut by a double isotope derivative assay (DIDA) which included recrystallization to constant $^{3}H:^{14}C$ ratios. DIDA and/or fluorescence analyses of halibut plasma indicated a range of 5.3-46.9 μg cortisol and 0.28-3.2 μg cortisone per 100 ml of plasma. Although cortisol was definitively identified following endogenous incubations of head kidney tissue, no cortisol was detected from incubated trunk kidney tissue. This result correlated with the presence of groups of adrenocortical cells (eosinophilic cytoplasm and prominent nucleolus) in the incubated head kidney tissue and the absence of such groups of cells in the incubated trunk kidney tissue. (Authors)

15922. McKenzie, Joseph A. (Dept. of Biol., Univ. of New Brunswick, Fredericton, New Brunswick, Canada). 1973. COMPARATIVE ELECTROPHORESIS OF TISSUES FROM BLUEBACK HERRING Alosa aestivalis (Mitchill) AND GASPAREAU Alosa pseudoharengus (Wilson). Comp. Biochem. Physiol., 44(1B): 65-68.

Lactate dehydrogenase and total protein electrophoretic patterns were determined and compared between Alosa aestivalis and A. pseudoharengus. Both A. aestivalis and A. pseudoharengus are five isozyme (LDH) fish with the mobilities of the isozymes being identical in the two species. The muscle myogen patterns of the two species are different and species specific. No intraspecific variation in either species was found among 395 A. aestivalis and 416 A. pseudoharengus examined. Muscle myogen and LDH electrophoretic patterns are of little use as biochemical population markers. (Auth.)

15923. Turner, Bruce J. (Dept. of Zool., Univ. of Calif., Los Angeles, California). 1973. GENETIC VARIATION OF MITOCHONDRIAL ASPARTATE AMINOTRANSFERASE IN THE TELEOST Cyprinodon nevadensis. Comp. Biochem. Physiol., 44(1B): 89-92.

An apparent genetic polymorphism of mitochondrial aspartate aminotransferase was discovered in a population of the Nevada pupfish, Cyprinodon nevadensis, from the Amargosa River in Death Valley, California. Three phenotypes were noted. Presumptive homozygotes display single bands of activity; presumptive heterozygotes display the characteristic triplet pattern expected from the random combination of two different (allelomorphic) monomers into dimers. The phenotypic frequency distribution is in agreement with that predicted by a Hardy-Weinberg equilibrium for a one-locus di-allelic polymorphism with allelic frequencies of 0.8 and 0.2. (Auth.)

15924. Kramer, B. (Zool. Inst. der Univ., Siesmayerstrasse 70, D-6 Frankfurt a. M., Germany). 1972. BEHAVIOURAL EFFECTS OF AN ANTIGONADOTROPIN, OF SEXUAL HORMONES, AND OF PSYCHOPHARMAKA IN THE PUMPKINSEED SUNFISH, Lepomis gibbosus (CENTRARCHIDAE). Experientia, 28(10): 1195-1196.

A synthetic antigonadotropin (methallibure, I.C.I.) inhibits the sexual- and nest-building behavior of the male sunfish (Lepomis gibbosus). On the contrary, testosterone increases aggressive behavior, and mammalian-LH the sexual tendency in addition. Reserpine raises the fighting mood; chlorpromazine on the other hand inhibits the fighting- and nest-building mood, but not the sexual tendency. (Auth. summ.)

15925. Noble, Richard L. (Dept. of Wildl. and Fish. Sci., Texas A&M Univ., College Station, Texas 77840). 1972. A METHOD OF DIRECT ESTIMATION OF TOTAL FOOD CONSUMPTION WITH APPLICATION TO YOUNG YELLOW PERCH. Prog. Fish-Cult., 34(4): 191-194.

The Bajkov method of estimating daily consumption is modified for feeding periodicity. Application of the method to young yellow perch indicated that the number of organisms in the stomach at mid-day represents 1/4 of the total daily consumption. (Auth.)

15926. Hagenmaier, H. E. (Zool. Inst. der Techn. Hochschule Aachen, Aachen, Germany). 1972. ON THE HATCHING PROCESS IN FISH: II. OBTAINING AND CHARACTERIZING THE HATCHING SECRETION IN THE RAINBOW TROUT (Salmo gairdneri Rich.). [Zum Schlüpfprozess bei Fischen: II. Gewinnung und Charakterisierung des Schlüpfsekretes bei der Regenbogenforelle (Salmo gairdneri Rich.)]. Experientia, 28(10): 1214-1215. In German with English summary.

A method is described to get the secretion of the hatching glands together with the perivitelline fluid by stimulating the eggs of Salmo gairdneri with dissolved gaseous nitrogen in various buffers. Characterizing this fluid by various methods there could be shown some enzymes of which a proteinase alone seems to be the real "hatching enzyme". (Auth. summ.)

15927. Zirges, Malcolm H., and Lyle D. Curtis (Fish Comm. of Oregon, Elk River Salmon Hatchery, Port Orford, Oregon 97465). 1972. VIABILITY OF FALL CHINOOK SALMON EGGS SPAWNED AND FERTILIZED 24 HOURS AFTER DEATH OF THE FEMALE. Prog. Fish-Cult., 34(4): 190.

Previous experimental tests of the viability of eggs of some species of Pacific salmon held for varying periods of time after death of the female have met with poor success. A female fall chinook salmon was inadvertently left on a stream bank exposed to air temperatures of 27° - 45° F. for 24 hours before rediscovery and subsequent fertilization of the eggs with sperm of a live male. Egg survival was 65.3% to hatching. Eggs from several other females similarly held for varying periods up to 12 hours after death were fertilized with egg survival rates over 80%. (Authors)

15928. Hale, John G., and Anthony R. Carlson (U. S. Environ. Protection Agency, Natl. Field Investigations Center, Bldg. 22, Rm. 111, Denver Federal Center, Denver, Colorado 80225). 1972. CULTURE OF THE YELLOW PERCH IN THE LABORATORY. Prog. Fish-Cult., 34(4): 195-198.

Yellow perch, Perca flavescens (Mitchill), were cultured successfully under laboratory conditions. Larvae were reared under static conditions and at 4 and 6 water turnovers per 24 hours. Survival decreased as the flow rate increased. Larval survival was higher in tanks with dark-colored bottoms than in tanks with light-colored bottoms. Zooplankton densities of at least 250 organisms per feeding per larva fed 4 times daily are needed to obtain a minimum of 50% survival of 50 larvae for a period of 3 weeks following hatching. Training of fish to eat trout-starter mash commenced 3 weeks after majority hatch. (Authors)

15929. Klein, W. D. (Colo. Div. of Wildlife, Fort Collins, Colorado 80521). 1972. ANALYSIS OF A CREEL-SIZE TROUT PLANT IN PARVIN LAKE UNDER ARTIFICIAL LURE FISHING. Prog. Fish-Cult., 34(4): 199-203.

A plant of 497 hatchery-reared, creel-size, rainbow trout (Salmo gairdneri) was rapidly decimated by angling with artificial lures, primarily spinning gear with flies as terminal tackle. Of the original plant, 31.2% were harvested during the first week, 73.4% the first six weeks, 82.1% the first year, 5.0% the second year, and 0.6% the third year, for a total harvest of 87.7%. Angling was selective for larger fish. Faster growth was noted among the smaller of the trout remaining in the lake for a sustained period. There was no significant difference in total harvest of small (under 11.0 in.) and large (11.0 in. and over) trout. Comparing return-to-the-creel data of stocked, creel-size, rainbow trout in Parvin Lake, under conditions of no restrictions on terminal tackle and artificial lure fishing failed to indicate that relief was afforded the hatchery product by the latter procedure. Domesticated strains of rainbow trout stocked as fingerlings were compared with the creel-size group under artificial lure fishing. Returns to the creel revealed more rapid removal of trout stocked at creel size; trout from the two sources were of comparable size when the harvest was compared. (Auth.)

15930. Hastings, W. H., Bill Hinson, Dewey Tackett, and Bill Simco (Bur. of Sport Fish. and Wildl., Fish Farming Exp. Sta., Stuttgart, Arkansas 72160). 1972. MONITORING CHANNEL CATFISH USE OF A DEMAND FEEDER. Prog. Fish-Cult., 34(4): 204-206.

A mechanism is described that permits the continuous monitoring of time intervals that feed leaves a demand feeder. Data collected from the use of this mechanism suggest that catfish fingerlings feed more frequently during the afternoon hours of the summer months and at a daily rate of about 4% of their body weight. Winter feeding with large catfish occurs at fairly regular intervals throughout the day and at a daily rate of about 1-1/4% of their body weight. (Authors)

15931. Brauhn, James L., Delmar Holz, and Richard O. Anderson (Bur. of Sport Fish. and Wildl., Fish-Pesticide Res. Lab., Columbia, Missouri 65201). 1972. AUGUST SPAWNING OF LARGEMOUTH BASS. Prog. Fish-Cult., 34(4): 207-209.

The spawning period of largemouth bass (Micropterus salmoides) was successfully delayed until mid-August by holding brood fish in cool water at 17.2°C. Bass were stocked in three 0.1-acre ponds and allowed to spawn naturally. Each pond produced fingerlings. Facilities similar to those found in warm-water fish hatcheries were used. (Authors)

15932. Imlay, Marc J., and Margaret L. Paige (U. S. Environ. Protection Agency, Natl. Water Qual. Lab., Duluth, Minnesota 55804). 1972. LABORATORY GROWTH OF FRESHWATER SPONGES, UNIONID MUSSELS, AND SPHAERIID CLAMS. Prog. Fish-Cult., 34(4): 210-216.

The scientific literature shows that considerable effort has been devoted towards growing freshwater sponges, mussels, and clams under laboratory conditions, but with limited success. Granular trout-feed and the bacteria and other organisms growing from it served as a suitable food source in flowing laboratory water (either carbon-filtered city water or water pumped directly from Lake Superior). Some sponges increased many fold in size. The sponges also lost their gemmules and increased their number of narrow extensions, presumably as an effect of temperature and flow velocity. Two-year-old unionid mussels consistently grew 20% in length in 3 months, but required more time for food decomposition than did sponges. Sphaeriid clams grew at the same rate. (Authors)

15933. Kendle, Earl R., and Larry A. Morris (Nebraska Game and Parks Comm., Lincoln, Nebraska 68503). 1972. A GASTRIC BATTERY FOR FISH. Prog. Fish-Cult., 34(4): 216.

The feasibility of a small battery using the gastric juices in a fish's stomach as the electrolyte was investigated as a power source for miniaturized fish-tracking ultrasonic transmitters. Seven different metal plate combinations were tested for their potential to produce electric power and longevity in the gastric environment. The combination most successful for the intended purpose was a battery made of gold and cadmium plates. The output of this small battery in the stomach of a northern pike varied with the water temperature and averaged 0.50 milliwatts at 22°C. After such a battery had been contained in the stomach of a northern pike for 226 days, it was not visibly eroded and still produced as much power as when installed in the fish. The fish tolerated the battery well and was in good condition when removed from the pond for examination. Such a battery may be a useful power source for some of the newer transmitting equipment designed for use with fish. (Authors)

15934. Voyer, Richard A., and Raymond J. Hennekey (U. S. Environ. Protection Agency, Natl. Marine Water Qual. Lab., West Kingston, Rhode Island 02892). 1972. EFFECTS OF DISSOLVED OXYGEN ON TWO LIFE STAGES OF THE MUMMICHOG. Prog. Fish-Cult., 34(4): 222-225.

Adult mummichogs were exposed for 6 hours to a range of dissolved oxygen levels (0.4-7.2 mg DO/liter). Concentrations of dissolved oxygen lethal to 50% of the fish ranged from 0.74 to 0.89 and averaged 0.80 for three tests. Mummichog embryos were incubated at three dissolved oxygen concentrations for 27 days. Mortality was maximum at the 14th day of exposure and was inversely related to oxygen concentration. After 27 days exposure, 88% of the embryos hatched at 7.5 mg DO/liter, 62% at 4.5 mg DO/liter, and 9% at 2.4 mg DO/liter. A 50% hatch theoretically would have occurred at 3.9 mg DO/liter. (Authors)

15935. Warner, Kendall (Maine Dept. of Inland Fish. and Game, Bangor, Maine). 1972. FURTHER STUDIES ON FISH PREDATION ON SALMON STOCKED IN MAINE LAKES. Prog. Fish-Cult., 34(4): 217-221.

The role of 13 fish species as predators on newly stocked salmon (Salmo salar) was evaluated for 69 plantings in 36 Maine lakes from 1965-70. Four of the eight warmwater fishes studied preyed on salmon to some degree. Chain pickerel (Esox niger) were the most serious predators on stocked salmon, but pickerel predation was significantly reduced by scatter planting salmon over deep water. Smallmouth bass (Micropterus dolomieui) and largemouth bass (Micropterus salmoides) were also significant predators in some instances. Yellow perch (Perca flavescens) preyed on stocked salmon to a limited extent. Four of the five coldwater species studied preyed on newly stocked salmon. Burbot (Lota lota) appeared to be the most serious potential coldwater predator. Brown trout (Salmo trutta), lake trout (Salvelinus namaycush), and other salmon preyed on newly stocked salmon, but the degree of predation by salmonids is probably not of serious magnitude in most instances. (Auth.)

15936. Anderson, Douglas P., and Avron J. Ross (Bur. of Sport Fish. & Wildl., Western Fish Disease Lab., Seattle, Washington 98115). 1972. COMPARATIVE STUDY OF HAGERMAN REDMOUTH DISEASE ORAL BACTERINS. Prog. Fish-Cult., 34(4): 226-228.

Basic test diets containing different bacterial preparations of the etiologic agent of Hagerman redmouth disease were fed to rainbow trout. A chloroform preparation gave evidence of being the most effective, but the sonicated-formalized and phenol preparations were also found to reduce mortalities when the fish were subsequently challenged with virulent isolates of redmouth. No humoral antibody was detected in these fish when the serums were tested against redmouth disease bacterial antigens. (Authors)

15937. Perry, W. Guthrie, Jr., and James W. Avault, Jr. (La. Wild Life and Fish. Comm., Grand Chenier, Louisiana 70643). COMPARISONS OF STRIPED MULLET AND TILAPIA FOR ADDED PRODUCTION IN CAGED CATFISH STUDIES. Prog. Fish-Cult., 34(4): 229-232, 1972.

Catfish-Tilapia polyculture experiments recently conducted seem promising. However, the tilapia is an exotic whose value to commercial and sport fisheries is argued by many. The ability of these fish to survive in the warmer waters of our southernmost areas may present a definite threat to sport and commercial fisheries if these fish are permitted to become established. In a recent study the striped mullet (Mugil cephalus) was selected as an alternative species to the tilapia. Caged channel catfish (Ictalurus punctatus) were placed in three 0.1-acre ponds stocked with free swimming Tilapia aurea and in three ponds stocked with striped mullet. Three ponds containing catfish only served as a control. Catfish growth was determined bi-weekly and feeding rates adjusted accordingly. After 170 feeding days the fish were harvested due to the presence of Hurricane Edith, and production data were determined. The mullet, when stocked in ponds containing caged catfish and compared to tilapia stocked ponds, gave the highest total fish production per pond, the highest percent survival, and the best food conversion factor, the highest poundage of caged catfish and the largest percent of total harvestable sized fish. (Authors)

15938. Andrews, James W., Lee H. Knight, and Takeshi Murai (Skidaway Inst. of Oceanogr., Savannah, Georgia 31406). 1972. TEMPERATURE REQUIREMENTS FOR HIGH DENSITY REARING OF CHANNEL CATFISH FROM FINGERLING TO MARKET SIZE. Prog. Fish-Cult., 34(4): 240-241.

In order to determine the temperature requirements for high density rearing of channel catfish from fingerling to market size, two hundred 25-g channel catfish fingerlings were reared in 2.4-m-diameter fish culture tanks at temperatures of 24°, 26°, 28°, and 30°C. The optimal temperature in terms of growth and food conversion was between 28° and 30°C. In these two groups during a 6-month period, fish reached average individual weights of 564 and 555 g respectively with a food conversion (g feed/g gain) of 1.5 or less. (Authors)

15939. Wallace, Charles R. (Dept. of Zool., Univ. of Arkansas, Fayetteville, Arkansas 72701). 1972. EMBRYONIC AND LARVAL DEVELOPMENT OF THE SMALLMOUTH BASS AT 23°C. Prog. Fish-Cult., 34(4): 237-239.

This study describes the embryonic and larval development of smallmouth bass, Micropterus dolomieui Lacepede, spawned at 19°C and reared at a constant temperature of 23°C from 4-6 hours after fertilization. (Auth.)

15940. Greenland, Donald C., James E. Ellis, and Robert L. Gill (NMFS, Rohwer, Arkansas 71666). 1972. OPERATING AND DESIGN CRITERIA OF AN ADJUSTABLE HORIZONTAL BAR GRADER FOR SORTING CHANNEL CATFISH. Prog. Fish-Cult., 34(4): 186-190.

An adjustable bar grader was used to sort channel catfish under a variety of conditions with an average error of 11.2 percent. A curve was developed showing the bar spacing and fish size sorted with minimum error, for use as a guide for fish farmers in operating similar graders. Care should be taken in alining and drilling the holes when constructing this type of grader. The experimental unit could have been improved by adding higher sides and using rivets instead of bolts for anchoring the grader bars. From our experiences with this type of grader, it appears that it would be very useful in a catfish farming operation. It is inexpensive, can be constructed by the farmer, is durable, easy to operate, gives predictable results, does not injure the fish, has a high capacity, and can be used to sort a variety of sizes of channel catfish. (Authors' conclusion)

15941. DeCew, Mark G. (Wash. Dept. of Fish., Cowlitz Salmon Hatchery Lab., Salkum, Washington 98582). 1972. ANTIBIOTIC TOXICITY, EFFICACY, AND TERATOGENICITY IN ADULT SPRING CHINOOK SALMON (Oncorhynchus tshawytscha). J. Fish. Res. Bd. Canada, 29(11): 1513-1517.

Antibiotics were tested for toxicity and efficacy in adult spring chinook salmon (Oncorhynchus tshawytscha) infected with bacterial kidney disease and furunculosis. The complex of penicillin G procaine, dihydrostreptomycin sulfate, and oxytetracycline-HCl was not toxic and it effectively controlled both diseases, producing a three-fold increase in adult survival and production of viable eggs. Mandible and fin teratogenesis occurred in progeny of adults treated with the above antibiotic complex, but could be reduced by providing a 32 day interim between injection and spawning. (Auth.)

15942. Lockhart, W. L., J. F. Uthe, A. R. Kenney, and P. M. Mehrle (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg 19, Manitoba, Canada). 1972. METHYLMERCURY IN NORTHERN PIKE (Esox lucius): DISTRIBUTION, ELIMINATION, AND SOME BIOCHEMICAL CHARACTERISTICS OF CONTAMINATED FISH. J. Fish. Res. Bd. Canada, 29(11): 1519-1523.

Northern pike heavily contaminated with methylmercury were captured from Clay Lake, Ontario, and released in Heming Lake, Manitoba, an area relatively free of mercury. Mercury levels in muscle biopsy samples at the time of transfer and at subsequent recaptures indicated that only 30% was eliminated in one year. Distribution among various body tissues was essentially unchanged, those organs most heavily contaminated being lens, kidney, and liver in decreasing order. Biochemical profiles of blood serum constituents showed several differences between samples from the two lakes, especially in levels of inorganic phosphate, total protein, alkaline phosphatase, and cortisol. Serum values for transplanted fish tended toward those in the clean lake and we have concluded that biochemical profiles were sensitive to the environmental change. (Authors)

15943. Webb, P. W., and J. R. Brett (Fish. Res. Bd. of Canada, Pacific Biological Station, Nanaimo, British Columbia, Canada). 1972. RESPIRATORY ADAPTATIONS OF PRENATAL YOUNG IN THE OVARY OF TWO SPECIES OF VIVIPAROUS SEAPERCH, Rhacochilus vacca AND Embiotoca lateralis. J. Fish. Res. Bd. Canada, 29(11): 1525-1542.

15944. Webb, P. W., and J. R. Brett (Fish. Res. Bd. of Canada, Pacific Biological Sta., Nanaimo, British Columbia, Canada). 1972. THE EFFECTS OF SUBLETHAL CONCENTRATIONS OF WHOLE BLEACHED KRAFTMILL EFFLUENT ON THE GROWTH AND FOOD CONVERSION EFFICIENCY OF UNDERYEARLING SOCKEYE SALMON (Oncorhynchus nerka). J. Fish. Res. Bd. Canada, 29(11): 1555-1563.

Changes in growth rate and gross conversion efficiency were measured for underyearling sockeye salmon during and after exposure to full bleached kraftmill effluent (BKME). Five groups of fish were exposed for 56 days to 0, 1.0, 2.5, 10, and 25% BKME (v/v). Fresh 24-hr composite effluent at pH 6.8 was used daily after filtering. Growth was followed for a further 56 days after BKME exposure. Temperature was held at 15 C and dissolved oxygen between 90 and 100% air saturation. Growth rate and conversion efficiency were unaffected at 1.0 and 2.5% BKME. Reduced mean growth rate and conversion efficiency at 10% BKME were not statistically significant from controls but were considered to be biologically important in estimating threshold response levels. Significant reductions were found at 25% BDME. No recovery in retarded growth was found after exposure to BKME. Condition factor and percentage dry weight were not affected. It was concluded from computed response curves that the EC50 of the effluent was approximately 3.7% (v/v). (Authors)

15945. Kabata, Z. (Fish. Res. Bd. of Canada, Pacific Biological Sta., Nanaimo, British Columbia, Canada). 1972. DEVELOPMENTAL STAGES OF Caligus clemensi (COPEPODA: CALIGIDAE). J. Fish. Res. Bd. Canada, 29(11): 1571-1593.

Morphology of developmental stages of Caligus clemensi (Copepoda: Caligoida), a parasite of important commercial fish species, is described. The development cycle consists of two nauplius stages, one copepodid, four chalimus stages, and one preadult. This cycle is compared with ontogeny of five other species of Caligidae. The author concludes that one preadult stage has been missed in the cycle of C. clemensi and that evidence so far available points to existence of a ten-stage cycle of development, including two preadult stages and the adult. (Auth.)

15946. Dickman, Mike, and Ian E. Efford (Inst. of Resource Ecology, Univ. of Br. Columbia, Vancouver, British Columbia, Canada). 1972. SOME EFFECTS OF ARTIFICIAL FERTILIZATION ON ENCLOSED PLANKTON POPULATIONS IN MARION LAKE, BRITISH COLUMBIA. J. Fish. Res. Bd. Canada, 29(11): 1595-1604.

After single applications of nutrients to enclosures in Marion Lake in each of three seasons (fall, summer, and spring), primary productivity always increased within a 2-week period whether nitrate, phosphate, or a combination of the two was used. The species that responded to the three nutrients generally differed both within and between seasons. In all seasons, there was a decrease in total plankton diversity (based on productivity) accompanied by an increase in relative productivity of a few phytoplankton species. During fall, phosphate (P) was most stimulatory, raising primary productivity 6 mg C/m^3 per hr above that of the unenriched control. During spring, N+P was most stimulatory (23 mg C/m^3 per hr) and nitrate (N) next (11 mg C/m^3 per hr). In summer, N+P was again most stimulatory (44 mg C/m^3 per hr), primary production in the untreated lake rarely exceeding 4 mg C/m^3 per hr. Of the species that increased in density, 78% were not detectable (< 1 cell/ml) at the time of fertilization. A rapid increase in density of rare species culminated in an algal bloom 2-3 weeks after fertilization. After the first phase of succession following fertilization, there was an increase in plankton diversity. At 1.5 months after fertilization, the diversity and the number of species detected were as high as or higher than before fertilization. In addition, the number of phytoplankton species per liter did not decrease significantly after enrichment though diversity decreased sharply due to the increase in abundance of a few species. (Authors)

15947. Klima, Edward F. (NMFS, Southeast Fish. Center, Pascagoula Lab., Pascagoula, Mississippi 39567). 1972. VOLTAGE AND PULSE RATES FOR INDUCING ELECTROTAXIS IN TWELVE COASTAL PELAGIC AND BOTTOM FISHES. J. Fish. Res. Bd. Canada, 29(11): 1605-1614.

Laboratory observations on fish reactions to different voltages and direct current pulse rates provided information on the electrical characteristics needed for inducing electrotaxis for use in a proposed automated harvesting system. Optimal electrical combinations for 12 species of coastal pelagic and bottom fishes varied according to species and length, and ranged from 1.5 to 3.0 v/10 cm at 15-45 pulses/sec with a pulse duration of 1.0 msec. (Auth.)

15948. Bryan, James E., and P. A. Larkin (Inst. of Animal Resource Ecology, Univ. of Br. Columbia, Vancouver 8, British Columbia, Canada). 1972. FOOD SPECIALIZATION BY INDIVIDUAL TROUT. J. Fish. Res. Bd. Canada, 29(11): 1615-1624.

Analyses of stomach contents showed that the kinds of prey eaten by brook trout (Salvelinus fontinalis), cutthroat trout (Salmo clarki), and the rainbow trout (Salmo gairdneri) were seldom distributed at random among the individuals. Repeated observation of food eaten by individuals in a stream and ponds showed that prey types were eaten in proportions which were characteristic for an individual. Specialization occurred on several different kinds of prey. Although the degree of specialization was higher during shorter intervals, the data suggested that some specialization persisted for half a year. There were no striking correlations between degree of specialization and other individual properties such as size, growth rate, weight of food, number of food items, previous specialization, or area of recapture. In addition to the observations on trout in relatively undisturbed habitats, a field experiment was conducted using laboratory-reared rainbow trout held in small ponds. The food of each trout in the experiment was sampled repeatedly. In analysis of variance, interaction among the individuals and kinds of prey eaten showed that food specialization occurred. Both the absolute and relative abundance of potential prey were constant during the experiment. (Authors)

15949. Schindler, D. W., R. V. Schmidt, and R. A. Reid (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg R3T 2N6, Manitoba, Canada). 1972. ACIDIFICATION AND BUBBLING AS AN ALTERNATIVE TO FILTRATION IN DETERMINING PHYTOPLANKTON PRODUCTION BY THE ^{14}C METHOD. J. Fish. Res. Bd. Canada, 29(11): 1627-1631.

Acidification and bubbling was found superior to membrane-filtration for post-incubation treatment of ^{14}C-productivity samples. The method eliminates errors associated with filtration. Results are compared with those of conventional and corrected filtration procedures, and application of the method is discussed. (Authors)

15950. Vladykov, V. D., and C. G. Gruchy (Dept. of Biol., Univ. of Ottawa, Ottawa, Ontario, Canada). 1972. COMMENTS ON THE NOMENCLATURE OF SOME SUBGENERA OF SALMONIDAE. J. Fish. Res. Bd. Canada, 29(11): 1631-1632.

Nomenclatural problems in some subgenera of Salmonidae are cleared away with the diagnoses of three new subgenera, viz: Parahucho Vladykov, Parasalmo Vladykov, and Rhabdofario Cope. (Authors)

15951. Scott, K. R. (Fish. Res. Bd. of Canada, Freshwater Inst., Winnipeg R3T 2N6, Manitoba, Canada). 1972. COMPARISON OF THE EFFICIENCY OF VARIOUS AERATION DEVICES FOR OXYGENATION OF WATER IN AQUARIA. J. Fish. Res. Bd. Canada, 29(11): 1641-1643.

Efficiences of aeration of five different combinations of venturis, air stones, and sprays were measured in a 1.8-m^3 tank. Results showed that the venturi method discharging through a nozzle near the tank bottom had the highest efficiency. Air stones were 53% as effective and sprays directed at the surface 41% as effective as the venturi method. Details are given for fabrication of the PVC (polyvinyl chloride) venturi. The unit is reliable, inexpensive, and eliminates the need for a separate air supply. (Auth.)

15952. Demory, Robert L. (Fish Comm. of Oregon, Newport, Oregon 97365). 1972. SCALES AS A MEANS OF AGING DOVER SOLE (Microstomus pacificus). J. Fish. Res. Bd. Canada, 29(11): 1647-1650.

An aging technique by means of scales is described for Dover sole Microstomus pacificus. Agreement after two readings was 50%, but increased to 80% after three readings. Validation of the first annulus was established after examination of juvenile scales over a period of time during the first year of benthic residence. Location of the first annulus is contrary to published accounts. Scales offer a superior method of aging, especially for older fish. Interpretation and accuracy of scales from Dover sole males that remain in deep water one or more years is questionable. (Auth.)

15953. Hamley, John M. (Dept. of Zool., Univ. of Toronto, Toronto, Ontario, Canada). 1972. USE OF THE DeLURY METHOD TO ESTIMATE GILLNET SELECTIVITY. J. Fish. Res. Bd. Canada, 29(11): 1636-1638.

Catch-effort methods of population estimation can also be applied to estimate the selectivity of fish gear. Extensions of DeLury's formulae are considered, and the method is demonstrated on published data of gillnetting whitefish. (Auth.)

15954. Jensen, A. L. (Div. of Environ. Res. and Development, Tenn. Valley Authority, Chattanooga, Tennessee 37401). 1972. POPULATION BIOMASS, NUMBER OF INDIVIDUALS, AVERAGE INDIVIDUAL WEIGHT, AND THE LINEAR SURPLUS-PRODUCTION MODEL. J. Fish. Res. Bd. Canada, 29(11): 1651-1655.

The identity $B_t = N_t\overline{W}_t$, where B_t is the population biomass, N_t is the population size, and $\overline{W}_t$ is the average individual weight for all ages, is applied to develop simultaneous equations for change in biomass, number of individuals, and average individual weight for the linear surplus-production equation. It is shown that equations for all three variables cannot be simultaneously logistic. The relation between $\log_e N_t$ and $\log_e \overline{W}_t$ predicted by the linear surplus-production model is compared with observations of bluegill population densities and average weights estimated from 10 years of cove rotenone sampling in five large TVA reservoirs. The fit of the model to the data is fairly good, but it accounts for only a small amount of the total variation observed. (Auth.)

15955. Kanep, S. V. (State Res. Inst. for Lake and River Fish. (GosNIORKh), Leningrad, USSR). 1971. SOME ASPECTS OF THE FUNCTIONAL MORPHOLOGY OF THE LAKE PELYAD [Coregonus peled (Gmelin)]. Journal of Ichthyology, 11(6): 855-866.

Features of the adaptation of the pelyad to conditions of movement, feeding and growth in the lakes of the Northwest have been investigated. The structure of the gill apparatus is adapted to specific conditions. The number of gill rakers on the first arch is formed in the underyearling stage and remains relatively stable in adult fish. The development of the proportions of the body, the relative size of the head and fins, and the general shape of the body characterize the pelyad as a maneuverable, pelagic species adapted to the seizing of food uniformly dispersed in the water. Meristic characters remain practically invariable with age and do not differ significantly in different pelyad populations. No differences were discovered between males and females.

15956. Gorbach, E. I. (Lab. of Freshwater Fishes, Amur Div., Pacific Res. Inst. for Sea Fish. and Oceanogr. (TINRO), Khabarovsk, USSR). 1972. CONDITION AND FATNESS OF THE GRASS CARP [Ctenopharyngodon idella (Val.)] IN THE AMUR BASIN. Journal of Ichthyology, 11(6): 880-890.

The condition and fatness of the grass carp are considered in relation to size, age, sex, the stage of maturity of the gonads, the season and the availability of food. It is established that changes in the condition and fatness of this species are due to the physiological state of the organism and to the effect of food supply.

15957. Clifford, Thomas J., and Stephen Facciani (Wyoming Game and Fish Comm., Casper, Wyoming 82601). 1972. Philometra nodulosa IN WYOMING WHITE SUCKERS. Prog. Fish-Cult., 34(4): 235-236.

15958. Pirozhnikov, P. L. (State Res. Inst. for Lake and River Fisheries (GosNIORKh), Leningrad, U. S. S. R.). 1971. DISTRIBUTION AND FOOD OF THE BALTIC WHITEFISH [Coregonus lavaretus (L.)] IN THE GULF OF FINLAND. Journal of Ichthyology, 11(6): 872-879.

The paper is based on the data of 158 trawlings from a research vessel in 1968-1970. The stomach contents of 138 specimens of Coregonus lavaretus (L.) were examined. The near-bottom salinity of approximately 8 °/oo and the reduced oxygen content at the bottom should be regarded as factors limiting the extensive occupation of the Gulf by whitefishes. Pontoporeia affinis is the main food item of the form of the whitefish with an average number of gill rakers in the eastern part of the Gulf. This species is consumed in large quantity by the pope [Acerina cernua (L.)], the eelpout [Zoarces viviparus (L.)] and the young of the fourhorn sculpin [Myoxocephalus quadricornis (L.)], the populations of which are distinguished by high abundance. The nutrition of whitefishes varies within wide limits in each region. Seasonal features are noted: increased stomach content indices in June and September-October, and reduced indices in July.

15959. Verigin, B. V., and A. P. Makeyeva (Dept. of Ichthyology, Moscow Univ., Moscow, USSR). 1971. EXPERIMENTAL DETERMINATION OF PITUITARY GLAND ACTIVITY. Journal of Ichthyology, 11(6): 890-897.

Loach females were used in determining the activity of different samples of wild carp pituitaries treated with acetone, which had been commercially prepared in the Volga Delta, the Aral Sea and Lake Balkhash in the period 1966-1969. The activity of each sample had specific features. In practice, activity was 4-5 loach units per 1 mg. The activity of female carp pituitaries was more than 3 times that of male pituitaries. Pink salmon pituitaries were 2-3 times less effective, and chum salmon pituitaries 10 times less effective than carp pituitaries. A number of questions are raised concerning procedure the the determination and expression of pituitary activity.

15960. Grachev, L. Ye. (All-Union Res. Inst. for Sea Fish. and Oceanogr., (VNIRO), Moscow, USSR). 1971. ALTERATION IN THE NUMBER OF OOCYTES IN THE SOCKEYE [Oncorhynchus nerka (Walb.)] DURING THE MARINE PERIOD OF ITS EXISTENCE. Journal of Ichthyology, 11(6): 897-906

After the downstream migration of young sockeye to the sea the number of oocytes increases and reaches a maximum when the wieght of the ovaries is 100-200 mg. As the weight of the gonads increases further in the course of maturation the number of oocytes is reduced as a result of their degeneration in all sockeye age groups. The 'ultimate' fecundity is a quantity dependent on the time spent by the fish in the sea, the rate of maturation and growth rate.

15961. Sorokin, V. N. (Limnological Inst., Siberian Div., USSR Academy of Sci., USSR). 1971. THE SPAWNING AND SPAWNING GROUNDS OF THE BURBOT [Lota lota (L.)]. Journal of Ichthyology, 11(6): 907-915.

The spawning of the burbot has been investigated in the basin of Lake Baikal. Burbot spawning grounds in the Bugul'deyka and Kichera Rivers are described, and information is given concerning the density of burbot eggs in the spawning grounds and the characteristics of their development.

15962. Maksimov, V. P. (Dept. of Ichthyology, Biol. and Soil Sci. Faculty, Moscow Univ., USSR). 1971. THE BIOLOGY OF THE SAILFISH [Istiophorus platypterus (Shaw et Nodder)] IN THE ATLANTIC OCEAN. Journal of Ichthyology, 11(6): 850-855.

The results of observations on the biology of the Atlantic sailfish are set out in the paper. Data are given on vertical distribution, reproduction, size composition and food.

15963. Anderson, Max A., and Silas L. Paulson (U. S. Environ. Protection Agency, Ind. District Office, Evansville, Indiana 47711). 1972. A SIMPLE AND INEXPENSIVE WOOD-FLOAT PERIPHYTON SAMPLER. Prog. Fish-Cult., 34(4): 225.

15964. Konchin, V. V. (Dept. of Ichthyology, Moscow Univ., Moscow, USSR). 1971. THE RATE OF OXYGEN CONSUMPTION IN THE EARLY ONTOGENY OF THE SUMMER BAKHTAK [Salmo ischchan (Kessler)] WHEN PLACED IN RESPIRATORS IN GROUPS AND SINGLY. Journal of Ichthyology, 11(6): 916-925.

The method of closed vessels was used to determine the rate of oxygen consumption in different sized groups of eggs in the successive stages of development, and also in summer bakhtak prolarvae, larvae and fingerlings singly and in groups. A comparison was made of the results of determinations of the rate of respiratory exchange in the respirator vessels when the water was kept in continuous circulation during the experiment and when the water was not mixed. It was demonstrated that no differences were noted in the rate of oxygen consumption when equal conditions were created for the supply of oxygen to the respiratory surfaces of isolated individuals and individuals kept in groups, i.e., the group effect is absent from the initial stages in the development of summer bakhtak embryos to fingerling stages.

15965. Malyukina, G. A., and Ye. A. Marusov (Biol. and Soil Faculty, Moscow Univ., Moscow, USSR). 1971. STUDY OF THE OLFACTION OF FISHES BY ELECTROCARDIOGRAPHY. Journal of Ichthyology, 11(6): 959-966.

The olfactory characteristics of several species of freshwater fish were investigated by recording reflex changes of cardiac activity on stimulation of the olfactory lining by an odor. The stimuli employed were a number of natural odors and different classes of organic chemicals. There were found to be consideral species differences and also seasonal and sexual differences in sensitivity to the odors employed. A high capacity to perceive and differentiate natural odors, which are evidently of importance as signals in migratory behavior, was detected in the Lake Sevan trout migrating to spawn.

15966. Kulikova, N. I. (Amur Dept., Pacific Res. Inst. for Sea Fish. & Oceanog. Khabarovsk, USSR). 1971. INTRASPECIFIC VARIABILITY OF KARYOTYPES OF THE CHUM SALMON [Oncorhynchus keta (Walb.)]. Journal of Ichthyology, 11(6): 977-983.

The task of the present paper is a study of the karyotypes of several local stocks of the chum in the Soviet Far East with the object of clarifying their differences. The karyotypes of the chum of all the stocks investigated are typified by the following general characters: a stable number of chromosomes (2n = 74), the existence of secondary constrictions localized in different parts of the chromosomes, the lack of chromosomes with satellites, the existence of polyploid sets of chromosomes, and the characteristic arrangement of the chromosomes in the metaphase: the longest chromosomes (especially acrocentric) lie along the margins of the plate, and the small chromosomes lie in the center. The length ratio of the longest and shortest chromosomes is approximately 1:2. The karyotypes of the autumn and summer races of the chum have the following differences: the number of metacentric and acrocentric chromosomes, and consequently, the number of arms is different in the summer and autumn chum. The autumn chum has 28 metacentric chromosomes (14 pairs) and the summer chum 20 (10 pairs); the summer chum has 54 acrocentric chromosomes (27 pairs) and the autumn chum 46 (23 pairs). The ratio of the number of metacentric and acrocentric chromosomes is 1.6 in the autumn chum and 2.7 in the summer chum. The karyotype of the Amur and Sakhalin autumn chum is similar; that of the Amur summer chum is similar to the Okhotsk chum. Similarity with respect to many morphological and biological characters was discovered in study of local stocks of the chum of the Iski River and the Amur summer chum; the Amur autumn chum shares a number of morphological features in common with the chum of the rivers of Sakhalin. Consequently, correspondence between morphological and karyological characters is to be observed for the chum, as for other species of salmon. This is probably related not only to different ecological conditions, but also to the origin of the races of the chum.

15967. Syrett, Roll F., and Walter F. Dawson (U. S. Environ. Protection Agency, Natl. Water Qual. Lab., Duluth, Minnesota 55804). 1972. AN INEXPENSIVE ELECTRONIC RELAY FOR PRECISE WATER-TEMPERATURE CONTROL. Prog. Fish-Cult., 34(4): 241-242.

15968. Hunn, Joseph B. (U. S. Dept. of Interior, Bur. Sport Fish. & Wildl., Fish Control Lab., LaCrosse, Wisconsin). 1972. BLOOD CHEMISTRY VALUES FOR SOME FISHES OF THE UPPER MISSISSIPPI RIVER. Journal of the Minnesota Academy of Science, 38(1): 19-21.

Plasma concentrations of sodium, potassium, calcium, magnesium, chloride, inorganic phosphate, glucose, lactic acid and total carbon dioxide and whole blood pH and hematocrit were determined for nine species of fish from the Upper Mississippi River area. Most of the values obtained fall within the range of values published for other freshwater fishes, except that the plasma concentrations of potassium and chloride in sexually mature walleye pike were low. The chloride was compensated for by a high plasma total carbon dioxide. Further studies should establish whether these blood chemistry values may be considered of normal range. (Auth.)

15969. Tagmaz'yan, Z. I. (Sakhalin Bd. for the Conservation and Reproduction of Fish Stocks and the Regulation of Fishing (Sakhalinrybvod), USSR). 1971. RELATIONSHIP BETWEEN THE DENSITY OF THE DOWNSTREAM MIGRATION AND PREDATION OF YOUNG PINK SALMON [Oncorhynchus gorbuscha (Walb.)]. Journal of Ichthyology, 11(6): 984-987.

At the time of downstream migration of young pink salmon predatory fish remain in the pools during the daytime. At night they migrate to the rapids, where they feed on the downstream migrating young. A considerably higher concentration of young is to be noted here, than in the pools, and the probability that downstream migrating young will encounter predators is greatest. A high mean daily density of downstream migration, reaching several hundred units, is observed throughout June in the small spawning rivers characteristic for Sakhalin, and only where a relatively abundant spawning stock of the pink salmon has been preserved. The density of downstream migration is extremely low in the main channels of large rivers. Predatory fish begin to feed systematically on young pink salmon when a high density of downstream migration is reached (above 100 units), and young pink salmon play a considerably greater role in the diet of the Siberian char at this time than in the diet of the Dolly Varden char and the masu salmon.

15970. Shcherbina, M. A. (Lab. of Physiol. and Biochem., All-Union Pond Fish. Res. Inst. (VNIIPRKh), Settlement of Rybnoye, Moscow Province, USSR). 1971. THE EFFECT OF PROTEINASE INHIBITORS ON THE NUTRITIVE VALUE OF SOYBEAN MEAL AS FOOD FOR THE CARP (Cyprinus carpio L.). Journal of Ichthyology, 11(6): 992-995.

The feeding of carp on pure soybean meal made it possible to obtain a food effect similar to that in warm-blooded animals. Therefore, the inhibiting factors of soybean meal which inhibit the action of digestive proteases and which have a stunting effect on the growth of warm-blooded animals, cause a similar physiological reaction in cold-blooded animals (carp).

15971. Vladimirov, V. I. (Inst. of Hydrobiol., Ukrainian Academy of Sciences, Kiev, USSR). 1971. VARIATION IN THE RATE OF ACCUMULATION OF ZINC IN RELATION TO INCREASED CONCENTRATIONS IN THE EARLY STAGES OF EMBRYOGENY AND THE VIABILITY OF CARP (Cyprinus carpio L.) LARVAE. Journal of Ichthyology, 11(6): 988-991.

The positive role of physiological doses of the trace element zinc introduced into the organism in ionic form in the early stages of embryonic development results not only from the fact that the organism receives an addition of the trace element if it is in short supply, but also from the fact that this addition may, under certain conditions, improve and normalize the direction of the metabolism of the trace elements concerned in the organism in the subsequent stages of embryogeny and postembryogeny. It is possible that what is of decisive importance here is that the trace element is introduced in ionic form. The rate and direction of zinc metabolism are largely, if not wholly, determined in the early stages of embryogeny.

15972. Reynolds, L. M. (Ontario Research Foundation, Toronto, Ont., Canada). 1971. PESTICIDE RESIDUE ANALYSIS IN THE PRESENCE OF POLYCHLOROBIPHENYLS (PCB'S). Pesticide Reviews, Vol. 34, pp. 27-57; Selected Water Resources Abstracts, 5(22): p. 38, 1972.

Since 1966, polychlorinated biphenyls (PCB's) have been detected in fish and wildlife. Due to their similarities in structure and properties to the organochlorine pesticides, the PCB's tend to interfere with accurate gas-liquid chromatography - electron capture determination of organochlorine and many organophosphorous pesticides. A method for recognizing the presence of PCB's in samples, separating them from pesticides, and accurately determining the pesticide levels is described. A simultaneous estimate of total PCB content is afforded. Further research on toxicity and sublethal effects of PCB mixtures and their individual components is required. If particular components are more toxic than others, refinement of the PCB quantitative methods will be necessary. Also discussed are uses and properties of PCB's, ecosystem kinetics and toxicity of PCB's, and residues of PCB's found in Canadian wildlife.

15973. Stober, Q. J. (Coll. of Fish., Washington Univ., Seattle, Washington). 1972. A SMALL BIOASSAY LABORATORY DESIGNED FOR EXPERIMENTAL THERMAL EFFECTS EVALUATION. Coll. of Fish., Fish. Res. Inst., Univ. of Washington Circular No. 72-1, 12 p; Selected Water Resources Abstracts, 5(22): p. 38.

Design details with drawings are presented for a small bioassay laboratory useful for specific site evaluation of large industrial developments. This laboratory has been operated at a proposed 1000 Mw nuclear power site in Northern Puget Sound (Kiket Island), Washington, since April, 1970. The laboratory is described, as well as the individual systems, including salt-water supply, heating, temperature control, compressed air supply, and emergency power supply. Experimental equipment and laboratory maintenance are discussed. The laboratory building houses insulated wet and dry laboratories, a mechanical equipment room, and a boat storage experimental area.

15974. Boulton, P., and L. J. Hetling (Environ. Qual. Research and Development Unit, N. Y. State Dept. of Environ. Conservation, Albany, New York). 1972. A STATISTICAL ANALYSIS OF THE MERCURY CONTENT OF FRESH WATER FISH IN NEW YORK STATE. N. Y. State Dept. of Environ. Conservation, February, 1972, 16 p.; Selected Water Resources Abstracts, 5(22): p. 51.

Because of the concern for mercury concentrations in the fish in New York State, chemical analyses were made of the mercury concentrations in more than 3200 fish from 142 locations. The average mercury level for all fish was 0.44 ppm and the highest level found was 8.20 ppm in fish from Onondaga Lake. Excluding the findings for Onondaga Lake, the maximum concentration found was 3.40 ppm. Field personnel were instructed to wrap each fish in a separate plastic bag and freeze immediately. The frozen samples were collected at the Rome, New York Department of Environmental Conservation's Fish Pathology Laboratory and then sent to the Department of Health's Laboratory in Albany where they were stored in large freezers until the analyses were made. Fish muscle tissue excluding bone was processed for mercury analysis. The wet sample was digested in a mixture of sulfuric acid and hydrogen peroxide. Hydroxylamine HCl-NaCl solution and stannous chloride solution were then added simultaneously to the digestate to reduce the mercury to the ground state prior to analysis by atomic absorption spectroscopy on a Techtron Model A.A. 4 atomic absorption spectrophotometer. The absorbance of the mercury was recorded by a Sargent-Welch Model SRLG recorder. The value of the mercury in the fish was determined by comparison with a standard mercury solution. The data printouts and statistical analyses were done utilizing an IBM 360/50 computer and two programs from the University of California biomedical computer program package.

15975. Webb, P. W., and J. R. Brett (Fish. Res. Bd. of Canada, Pacific Biol. Sta., Nanaimo, British Columbia, Canada). 1972. OXYGEN CONSUMPTION OF EMBRYOS AND PARENTS, AND OXYGEN TRANSFER CHARACTERISTICS WITHIN THE OVARY OF TWO SPECIES OF VIVIPAROUS SEAPERCH, Rhacochilus vacca AND Embiotoca lateralis. J. Fish. Res. Bd. Canada, 29(11): 1543-1553.

15976. Bachop, William, and James H. McDonald (Dept. of Zool., Clemson Univ., Clemson, South Carolina 29631). 1972. EQUIVOCAL NATURE OF EVIDENCE ADDUCED AS DEMONSTRATING CHROMOSOMAL POLYMORPHISM IN BLASTOMERES OF OVIPAROUS TELEOSTS. J. Cell Biology, Vol. 55(2), part 2, p. 11a.

Investigators working on species in the genera Salmo and Oncorhynchus reported variation in chromosomal number from blastomere to blastomere within a single squashed blastula. Alternative explanations have been offered: (1) aneuploidy; (2) post-zygotic chromosomal rearrangements, e.g., intra-individual Robertsonian chromosomal polymorphism; (3) artifactual mingling of chromosomes from contiguous squashed cells. Inasmuch as blastomeres of oviparous teleosts overlie a syncytium whose nuclei can be seen in serial sections to exhibit the inconstancy of chromosomal number (J. Morph., 135: 239) that the aforementioned reports, based on squashes, have attributed to blastomeric nuclei, the possibility that squashed syncytial nuclei have been mistaken for squashed blastomeric nuclei must be considered in evaluating these reports. Since the cytoplasm of some blastomeres is for a time continuous with the protoplasm of the syncytium, statements that blastomeres have been dissected off the yolk cannot be taken to guarantee that blastomeres have been freed completely from the syncytium. The fact that the aforementioned authors imputing chromosomal polymorphism to blastomeres of oviparous teleosts have not even mentioned the syncytium is tantamount to proof that these authors were unaware of its existence, and therefore their imputations cannot be considered unequivocal. (Authors)

15977. Collins, Vera G. 1970. RECENT STUDIES OF BACTERIAL PATHOGENS OF FRESHWATER FISH. Water Treatment and Examination 19: 3-31. Reviewed by S. F. Snieszko, Eastern Fish Disease Lab., Kearneysville, West Va.

Occasionally papers are published which cover a wide subject and authors try to explain in depth the relationships between the cause and effect as influenced by environment. Such is the case in this very valuable paper in which the author presented her views on the effect of eutrophication on the aquatic bacteria and this in turn on the occurrence of diseases of fishes "caused" by bacteria. In the first part of the paper the author presented observations on the types of bacteria found in two lakes, one oligotrophic, the other eutrophic at different depth and different conditions. The same types of bacteria which are reorganized as pathogens of fishes were also predominant in the epilimnion. They included Pseudomonas, Aeromonas, Myxobacteria, and Flavobacteria. It is interesting that Corynebacteria were often found in the thermocline. Bacteriological examination of apparently healthy and visibly diseased fishes showed that the same types of bacteria mentioned above were also predominant in the surface and tissues of fishes. Pseudomonas and Aeromonas were the most common inhabitants of the surface of the fishes. On the gills Myxobacteria were most numerous. In the internal organs, the liver contained regularly gram positive bacteria of which Corynebacteria were predominant. Kidney tissue and heart blood were nearly always "sterile" but in the peritoneal cavity Aeromonas and Pseudomonas were present In the diseased fishes Aeromonas, Pseudomonas and Myxobacteria were found regularly in the external slime. Myxobacteria (columnaris), Pseudomonas and Aeromonas were on the gills, columnaris disease causing gill necrosis. The same types were on the fins and the top of the head. Corynebacteria were most regularly found in the liver. The kidney was less often infected and the heart blood was always free from bacteria. Pseudomonas and Aeromonas were regularly found in the peritoneal cavity. The author discussed the sequence of events consisting of water eutrophication, increase of bacterial flora and the incidence of diseases attributed to Aeromonas, Mycobacteria, and Pseudomonas. The author made no comments on the presence of Corynebacteria in water and liver of healthy and diseased fishes. It seems that it ought to be indicated that the fish disease known as the Dee disease in Great Britain and kidney disease in America is caused by Corynebacteria. This finding is very important because it will require modification of the approach to the examination of fishes as carriers of this important pathogen of freshwater salmonids. The paper includes excellent description of the columnaris disease and discussion which indicates that fishery biologists and fish disease workers are well aware of the role of the environmental stress on the outbreaks of bacterial diseases of fishes. This reviewer missed a more detailed information on the location and other characteristics of the lakes used by Dr. Collins as the subject of her studies. -- S. F. Snieszko

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15978. Bache, Carl A., James W. Serum, William D. Youngs, and Donald J. Lisk (Pesticide Residue Lab., Cornell Univ., Ithaca, New York). 1972. POLYCHLORINATED BIPHENYL RESIDUES: ACCUMULATION IN CAYUGA LAKE TROUT WITH AGE. Science, 177(4055): 1191-1192.

The concentration of polychlorinated biphenyls was shown to progressively increase with maturity in a series of lake trout. The presence of these compounds was determined by column chromatographic isolation, specific detector gas chromatography and mass spectrometry. The relation between fish age and the concentration of polychlorinated biphenyls was highly significant. (Authors)

15979. Timms, A. M., and H. Kleerekoper (Dept. of Biol., Texas A&M Univ., College Station, Texas). 1972. LOCOMOTOR RESPONSE OF GOLDFISH, CHANNEL CATFISH, AND LARGEMOUTH BASS TO A 'COPPER-POLLUTED' MASS OF WATER IN AN OPEN FIELD. Water Resources Research, 8(6): 1574-1580.

The locomotor response of goldfish, largemouth bass, and channel catfish to 'copper-polluted' water at a maximum concentration of 50 $\mu g/l$ Cu^{++} in an open field, free choice situation was monitored. The rate of water flow was 1.8 cm/sec. The largemouth bass were unaffected, but the goldfish and the channel catfish tended to orient themselves toward the source of the ion. The degree of this orientation was less, however, than that found in shallower gradients of the same copper concentration as described by Kleerekoper et al. in 1972. When goldfish were exposed to the copper ion in a uniform field so that neither avoidance of nor attraction to the polluted mass was possible, no change in orientation was observed. It is concluded that the slope of the copper gradient between 'clean' and 'polluted' water rather than the eventual highest concentration of the ion (50 $\mu g/l$) affected the orientation and the locomotor behavior of the catfish and the goldfish. (Authors)

15980. Koch, Henri J. A. (Zool. Inst. of the Univ., Leuven, Belgium). 1969. ELECTROFOCUSSING OF PROTEINS IN A NATURAL pH GRADIENT AS A TOOL IN POPULATION GENETICS. Special meeting on the Biochemical and Serological Identification of Fish Stocks, Dublin; Extrait du Rapports et Procès Verbaux, Vol. 161, pp. 160-166.

The haemoglobins of Salmo salar were investigated with the hope of being able to differentiate salmon populations spawning in different Scandinavian streams on the basis of their eventual protein polymorphism. The method of isoelectric focusing was applied to the problem of the characterization of the haemoglobins of Salmo salar. In the isoelectric focusing methods the protein to be analysed is introduced in a mixture of ampholytes of low molecular weight, having themselves different isoelectric points. Submitted in a vertical glass column to the influence of d. c. electric potential difference these ampholytes of low molecular weight stratify themselves in a pH gradient according to their own isoelectric characteristics. The stability of the gradient is obtained by means of a sucrose density gradient kept at low and nearly constant temperature. In such a gradient the proteins will reach a stationary position corresponding to their own isoelectric points. The essential result of the experiments so far is that they provide strong evidence in favor of the existence of a large number of haemoglobins in the blood of Salmo salar. These haemoglobins differ widely in isoelectric points. The number of haemoglobins in the blood of an adult salmon however far exceeds, on the anodic side, the number of components detected by means of starch gel electrophoresis methods. More than 25 haemoglobins with different isoelectric points may be present in the blood of a sexually mature salmon.

15981. Hines, R. (Fish and Aquaculture Sta., Dor, D. N., Hof HaCarmel, Israel). 1972. SOME COMMON DISEASES OF CARP IN ISRAEL. Refuah Vet., 29(1): 37-44. In Hebrew and English.

The article discusses the etiology and pathology of some of the more common diseases of carp in intensive pond culture in Israel. (Auth.)

15982. Grant, Blake F., and Richard A. Schoettger (Fish-Pesticide Research Lab., Route 1, Columbia, Missouri 65201). 1972. THE IMPACT OF ORGANOCHLORINE CONTAMINANTS ON PHYSIOLOGIC FUNCTIONS IN FISH. Proc. of the Inst. of Environmental Sciences, 1972 Annual meeting, New York, N. Y., pp. 245-250.

Measurement of physiological and biochemical effects of contaminants in fish may be a powerful tool in anticipating the subtle, adverse impact of these materials on aquatic ecosystems. However, this potential cannot be fully realized unless effects measured in such investigations can be strongly linked to (1) the inability of the fish to overcome normal and abnormal stress, (2) the amounts or rates of contaminant introduced and (3) the residue dynamics within the fish and its habitat.

15983. Walker, Charles R. (Branch of Pest Control Res., Div. of Fishery Research, Bur. of Sport Fisheries and Wildlife, Washington, D. C.). 1972. ECOLOGICAL IMPLICATIONS OF PESTICIDES USED IN OR NEAR AQUATIC ENVIRONMENTS. Proc. of the Inst. of Environmental Sciences, 1972 Annual meeting, New York, N. Y., pp. 235-237.

In order to provide optimum recreational facilities there is a need for use of pesticides -- a good example is in controlling the undesirable plants called weeds while encouraging the more desirable plants. This means weed control as an integral part of conservation to provide a more favorable environment for fish, waterfowl, the fisherman and the hunter.

15984. Environmental Science & Technology. 1972. POLLUTION CONTROL DIRECTORY 1972'73. Environmental Science & Technology, 6(11): 162 p.

This directory covers: Advertised products directory; Dealers and supply houses in the U. S.; Professional consulting services; Instruments and equipment; Chemicals; Services; Books and authors; Trade names; Events calendar; Company directory.

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